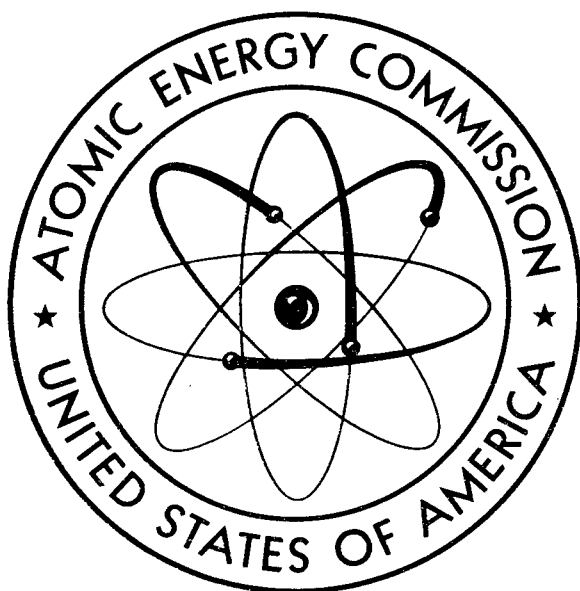


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# Radioisotopes in the Biological Sciences

An Annotated Bibliography  
of Selected Literature

Compiled by  
Helen L. Ward

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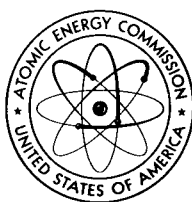
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Biology and Medicine  
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# RADIOISOTOPES IN THE BIOLOGICAL SCIENCES

An Annotated Bibliography of Selected Literature

Compiled by  
Helen L. Ward

April 1967



UNITED STATES ATOMIC ENERGY COMMISSION

Division of Technical Information Extension

# CONTENTS

INTRODUCTION . . . . .	v
ABSTRACT . . . . .	v
REFERENCES . . . . .	1
General Studies . . . . .	1
Cell Physiology . . . . .	19
Ecology . . . . .	24
Entomology . . . . .	30
Genetics . . . . .	33
Immunology . . . . .	39
Microbiology . . . . .	42
Nutrition . . . . .	61
Plant Physiology . . . . .	62
AUTHOR INDEX . . . . .	91
REPORT NUMBER AND AVAILABILITY INDEX . . . . .	102
ISOTOPES INDEX . . . . .	109



# ABSTRACT

This bibliography contains a total of 959 selected references on the use of radioisotopes in biological research. These references were selected from the scientific literature published during the period 1958-1963. Author, isotope, and report number indexes are included.

## INTRODUCTION

The use of radioactive isotopes as tracers has made possible great advances in biological research. Since the behavior of the radioisotope is identical with that of the stable isotope of the same element, and since it is possible to detect radiations emitted by the isotopes, many studies can be made which would not otherwise be possible.

The selective absorption of iodine by the thyroid gland permits studies of thyroid function. Radioactive iodine ( $I^{131}$ ) has been used for this purpose as well as for the diagnosis and treatment of thyroid disorders. Iodine-131 has also been used in labeling rose bengal, a dye employed in studies on liver function. In addition to physiology, many other biological sciences, such as cytology, ecology, entomology, genetics, immunology, and nutrition, have been advanced as a result of the availability of radioisotopes for research.

The major reference sources for this bibliography were: Nuclear Science Abstracts, The Bibliography

of Agriculture, Biological Abstracts, Chemical Abstracts, and Index Medicus. The period covered was 1958 through 1964.

Reprints of the journal articles cited in this bibliography are not available from the Atomic Energy Commission but should be obtained through regular library sources.

The following bibliographies are useful in conjunction with the present publication: Radioisotope Techniques in Biological Sciences, TID-3512; Radioisotopes in Medicine, TID-3514; Radioisotopes in Animal Physiology, TID-3515; Physiological Studies Employing Radioisotopes, TID-3515(Suppl. 1); Radioisotopes in Medicine, TID-3077; The Effects of Radiation and Radioisotopes on the Life Processes, TID-3098; Biological Effects of Ionizing Radiation, TID-3097.

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## GENERAL STUDIES

1 APPLICATIONS OF RADIOISOTOPES AND RADIATION IN THE LIFE SCIENCES. Hearings before the Subcommittee on Research, Development, and Radiation of the Joint Committee on Atomic Energy, Congress of the United States, Eighty-Seventh Congress, First Session, March 27, 28, 29, and 30, 1961. (United States. Congress. Joint Committee on Atomic Energy). 519p. \$1.50(GPO).

Separate abstracts have been prepared on 29 statements and papers presented.

2 (ORNL-3492(p.81-95)) RADIOACTIVE WASTE AREA AND RADIATION EFFECTS STUDIES. S. I. Auerbach, D. A. Crossley, Jr., P. B. Dunaway, et al. (Oak Ridge National Lab., Tenn.).

In dosimetry studies, miniature metaphosphate glass rods are being used to estimate absorbed dose in air and in the plants and soils of White Oak Lake bed. Combined beta and gamma doses in the top inch of mineral soil ranged from 20 to 25 rads/day on the northwest edge of the lake bed where  $\text{Ru}^{106}$  seepage from higher ground is appreciable. Absorbed doses in air at the surface of marsh plants (*Typha latifolia* L.) in this area ranged vertically from 6.2 rads/day at ground level to 2.8 rads/day at 5 ft above the ground. Absorbed doses in stem tissue of these plants were 23% higher due to absorbed radionuclides, principally  $\text{Ru}^{106}$ . The dose to root systems was three to seven times higher than the dose to shoot components. In food-chain studies of cotton rats maintained in pens on White Oak Lake bed and feeding on native vegetation, it was found that the concentrations of radionuclides in tissues are positively correlated with the corresponding concentrations in stomach contents and plants, the concentrations of radionuclides in tissues are not correlated with corresponding concentrations in soil,  $\text{Sr}^{90}$  in femurs is the only radionuclide in the tissues which was in greater concentration than in food or plants, and the placental and mammary barriers apparently were effective in reducing the concentration of  $\text{Sr}^{90}$  in fetuses and nursing young. Blood samples were taken from the original cotton rats one week before release into pens and at 4- to 6-week intervals thereafter. Blood analyses were also made on samples from rats born in the pens. Analyses of erythrocyte and leucocyte counts, leucocyte differential counts, hematocrits, mean corpuscular volumes, cell-volume distributions, and total serum solids were performed. These analyses showed no apparent effects of ionizing radiation in the blood of cotton rats maintained in the pens for this experiment. Studies on hematology of native mammals continued to support the previous discovery that the num-

ber of erythrocytes is inversely related to species size and that the mean erythrocyte volume is directly related to the species size. This relation was found to be present in the rodent families Muridae and Sciuridae, the shrew family Soricidae, and the primate family Cebidae. Seasonal effects on the blood of native mammals are being followed because of variations noted in cell counts and hematocrits of the blood of mammals trapped during various seasons of last year. Erythrocyte counts and hematocrits, for instance, in some species seemed to be higher in the winter than during other seasons. Use of trees as long-term monitors of radioactive seepage from underground waste pits was tested by sampling even-age pines growing around waste pit No. 5. Significant concentrations of four gamma-emitting radionuclides were found in these pine trees. These nuclides were  $\text{Ru}^{106}$ ,  $\text{Zr}^{95}$ - $\text{Nb}^{95}$ ,  $\text{Cs}^{137}$ , and  $\text{Ce}^{144}$ . Concentration of  $\text{Ce}^{144}$  was between 100 and 200  $\mu\text{c}$  per g of dry weight, which is the same as fallout levels.  $\text{Cs}^{137}$  concentration was uniform in all trees at 30 to 70  $\mu\text{c}$  per g of dry weight. This amount could be attributed to blowout from three open pits which are due west of waste pit No. 5.  $\text{Ru}^{106}$  concentration varied from 0.02  $\mu\text{c}$  per g of dry weight to fallout levels, which are 40 to 70  $\mu\text{c}$  per g of dry weight. Twenty-three of the 73 trees collected showed a concentration of  $\text{Ru}^{106}$  greater than that which could be attributed to fallout or to blowout from the open pits. This higher concentration is attributed to seepage (and subsequent uptake by the tree) from waste pit No. 5. Five trees showed a concentration of  $\text{Zr}^{95}$ - $\text{Nb}^{95}$  which was greater than fallout levels and also greater than  $\text{Ru}^{106}$  levels. The highest concentration of  $\text{Zr}^{95}$ - $\text{Nb}^{95}$  was 771  $\mu\text{c}$  per g of dry weight. Concentration of all the isotopes except  $\text{Zr}^{95}$ - $\text{Nb}^{95}$  tended to be greater in needle material than in twig material. Fission foil threshold detectors were used to determine the fast-neutron dose absorbed by white oak acorns irradiated in the ORNL Graphite Reactor. The acorns were irradiated in a 17 x 8 x 4.5 in. box of boron-carbide-impregnated Lucite, which absorbed thermal neutrons (over 50% of the total flux) but allowed fast neutrons to pass through the seed. Fission foils and pellets of  $\text{S}^{32}$  were placed under and on top of the sample to be irradiated, seed stacked to a depth of 4 in. After irradiation the foils and sulfur were counted immediately in the special fission foil counters of the Health Physics Division. Dose calculations were made according to the method of Hurst and Ritchie. The dose under 4 in. of acorns was 1755.8 rads/hr, whereas the dose over 4 in. was approximately 1250 rads/hr. Use of biological elimination of radioisotopes in insects as indirect measures of metabolism under field conditions was continued with emphasis on the influence of temperature on elimination rates. In geometrid caterpillars the biological half life of  $\text{Cs}^{137}$  was decreased by one-half for a 10° rise in

## REFERENCES

temperature. Similar temperature-related trends were found for leaf beetles (*Chrysomela knabi*) and millipedes (*Dixidesmus erasus*).

### 3 UCRL-9135

California. Univ., Berkeley. Lawrence Radiation Lab. BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] DECEMBER 1959, JANUARY AND FEBRUARY 1960. J. A. Bassham, ed. Mar. 18, 1960. 52p. Contract W-7405-eng-48. OTS.

Study of soluble green leaf protein (Fraction I) is reported in which chloroplast fragments containing particles of 100-A diameter were observed. Further study of these particles to determine their function is in progress. Studies of steady-state photosynthesis and growth in *Chlorella pyrenoidosa* were continued, and experiments to determine rates of amino acid synthesis are in progress. Algae nutrient solutions for these experiments are being studied. Experiments are described in which the role of glycolic acid in photosynthetic carbon metabolism in  $\text{CO}_2$  fixation is being studied. Glycolic acid was administered to *Chlorella* photosynthesizing in the presence of  $\text{C}^{14}\text{O}_2$ . A companion experiment was run in which acetate was the source of  $\text{C}^{12}$ . Tabulated data are included which indicate that both glycolate and acetate reduce the total fixation. Glutamic acid degradation studies are reported which were carried out to learn the way in which this compound is formed when  $\text{C}^{14}\text{O}_2$  is fed to photosynthesizing algae. Alternative degradation methods are discussed. In a study of the chemical effects of ionizing radiation on nucleotides, samples of uridylic acid were exposed to gamma radiation; resulting decomposition products are discussed. Experiments in which the degradation of toluene, formed when solid benzene is irradiated with  $\text{C}^{14}$  ions was partially completed. Energy values for carbon atom ring distribution are discussed and possible reactions are examined. A technique was developed for rapid processing of single samples in which  $\text{C}^{14}\text{O}_2$  is bound, by means of a quaternary ammonium base, into a form suitable for liquid scintillation counting. The method was also extended for application to the assay of  $\text{C}^{14}\text{O}_2$  in organic material combustion products. Experiments to test the hypothesis that increased training and more complete experience can influence rat brain cholinesterase (ChE) activity are described. Rats were subjected to experimental conditions, after which their cortical and subcortical ChE activity was determined. Analysis of results leads to the conclusion that environmental stimulation and training account for the difference in the pattern of ChE activity between the cortex and the subcortex. Data provide further indication that the cortical to subcortical ratio of activity is more sensitive to environmental influences than are the primary ChE measures. A previously reported experiment on the effects of  $\text{D}_2\text{O}$  on *Drosophila* was conducted in which the former results were not duplicated. Comparative data are included, and it is noted that the experiment is being repeated. (For preceding period see UCRL-9041.)

### 4 [USE OF RADIOISOTOPES IN STUDIES ON THE CHEMISTRY OF METABOLISM]. Statement of Dr. A. A. Benson (Pennsylvania State Univ., University Park). p.314-28 of "Applications of Radioisotopes and Radiation in the Life Sciences."

Uses of radioisotopes in studies of the chemistry of metabolism are reviewed. The radiochromatographic method of analysis is described in which paper chromatographic analysis is combined with tracer methods in studies of the dynamics of chemical reactions of the cell. Applications of the method in following the steps in photosynthesis and animal metabolism are described. Applica-

tions of activation analysis of biopsy samples in studies of animal metabolism are also described. This method eliminates the handling of radioactive materials. Studies on the identification and properties of surfactant compounds in plant cell membranes and protein-lipid interfaces only a few molecules thick are described which were made possible by the use of tracer methods.

### 5 AECU-4665

Sloan-Kettering Inst. for Cancer Research, New York. BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Semiannual Progress Report [for] Period: May 1, 1959-October 31, 1959. Dec. 1, 1959. 57p. Contract AT(30-1)-910. OTS.

A list of publications during the period and manuscripts in press is included. Progress is reported in the following studies: the electron spin resonance of free radicals in certain polycyclic hydrocarbon compounds which are carcinogenic, chemotherapeutic, or which have been irradiated; metabolic studies with calcium-45 and calcium-47 in bone disease; development of a whole-body scanner to improve resolution in isotope studies in patients; measurements of secondary electron spectra produced by internal isotope sources; *in vitro* studies of the metabolism of nucleic acid precursors in mammalian cells; developments of radioautographic technique for radioisotope tracer studies to demonstrate the incorporation of elements of compounds of biological interest into tissues; tracer studies in patients receiving labeled iodinated compounds, zinc-65, phosphorus-32, or gold-198; the design of a cesium-137 irradiator for laboratory animals, tracer studies on the growth inhibition of mammalian cells by selected antimetabolites; the interrelations of electrolyte balance and uric acid metabolism; a review of experience with iodine-131 in the treatment of hyperthyroidism and thyroid cancer; the synthesis of mercaptopurine nucleotides; physical and metabolic studies on purified ribonucleoprotein from rat liver; chemical studies of azapurine N-oxides; the direct thiation of heterocyclics with elementary sulfur; the physical characteristics of a number of nucleic acids; and the nature of the damage caused in mouse bone by exposure to 180 kvp x radiation.

### 6 TID-5955

Sloan-Kettering Inst. for Cancer Research, New York. BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Semiannual Progress Report for November 1, 1959 through April 30, 1960. May 1, 1960. 70p. Contract AT(30-1)-910. OTS.

An electron spin resonance spectrometer was placed in operation and used to examine a large number of carcinogenic aromatic hydrocarbons for negative free radical activity. Results are reported in studies on the metabolism of calcium-47 in patients with bone lesions; energy distributions of the electrons initially set in motion in water by gamma rays; tracer studies using carbon-14 to determine the effects of changes in thyroid function on the metabolism of hormonal steroids; growth inhibition of mammalian cells in tissue cultures which contain fluorinated pyrimidine nucleosides; and the localization of tritium-labeled nucleic acid precursors. Preliminary data are presented from a survey of approximately 55 patients who have received radioiodine in the treatment of metastatic thyroid cancer since 1944. The syntheses of mercaptopurine nucleotides was continued and preliminary experiments were carried out on the syntheses of *o*-2, 2'-cyclocytidine and 5-ribosyluracil. Physical studies on purified ribonucleoprotein from rat liver were continued. Attempts were made to obtain antibodies with

## REFERENCES

purine or adenine specificity. Desoxyribonucleic acid was separated into five or six fractions by means of the Swag deproteinization method. Educational activities of the Sloan-Kettering Institute are reviewed.

**7** (NYO-10152) BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Summary Progress Report, July 1, 1950–October 31, 1961. (Sloan-Kettering Inst. for Cancer Research, New York). Jan. 31, 1962. Contract AT(30-1)-910. 125p.

Progress is reported in kinetic studies of the metabolism of  $I^{131}$  and  $I^{131}$ -labeled compounds in man, the metabolism of  $Ca^{47}$  and  $Sr^{85}$  in patients with bone disease tracer studies on the metabolism of nucleic acid precursors and steroid hormones in man, measurements of electron spin resonance of free radicals produced in irradiated compounds of biological importance, measurements of secondary electron spectra produced by  $\gamma$ -emitting radioisotopes in water, radioautographic studies of isotope localization in tumors, bone marrow, and blood of leukemic patients, studies on the relationship of structure to biological activities and chemical properties of adenine and its monohydroxy derivatives, the development of techniques for the fractionation of nucleic acids, investigations on the physicochemical properties of nucleic acids, studies of the characteristics of the cytoplasmic ribonucleoprotein particles from mammalian tissue, and the quantitative measurement of the effects of x rays of different qualities on the bones of living mice and the correlation of these measurements with the amount of energy absorbed in the sensitive volumes of the bones. Educational programs are summarized and a list is included of publications during the period covered by this report.

**8** (TID-15330) BIOLOGICAL EFFECTS OF RADIATION, AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. Summary Progress Report, July 1, 1950–October 31, 1961. (Sloan-Kettering Inst. for Cancer Research, New York). Jan. 31, 1962. Contract AT(30-1)-910. 125p.

Progress is reported in studies on the metabolism of iodine and  $I^{131}$ -labeled compounds in man, metabolic studies with  $Ca^{47}$  and  $Sr^{85}$  in patients with bone disease, intermediary metabolism studies with labeled nucleic acid precursors, and studies on the metabolism of steroid hormones in man. Electron spin resonance spectroscopy was used in studies of free radical production in irradiated compounds of biological importance, measurements were also made of secondary electron spectra produced by  $\gamma$  rays in water. The accomplishments of these, and supporting projects are summarized. A bibliography of major publications is appended.

**9** ANL-5696

Argonne National Lab., Lemont, Ill.  
BIOLOGICAL AND MEDICAL RESEARCH DIVISION  
QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER,  
DECEMBER 1956. Mar. 1957. 122p. Contract W-31-  
109-eng-38. \$0.60(OTS).

Progress is reported in the following studies: measurements of antigenic specificity; the growth of mouse ascites tumor after serial transfer in rats; the effect of injected  $Y^{90}$  on the growth of ascites carcinoma in the mouse; the control of the mange mite on mice and dogs; the pathological effects of injected  $Sr^{90}$  in dogs and cats; factors influencing the formation of co-enzymes; the effects of x irradiation on blood volume and activity of the hematopoietic system in chicks; information content and biotology of the cell in terms of cell organelles as observed in *Paramecium*; the association of liver catalase with uricase-containing particulates in rats and mice; effects of

irradiation on spermatogenesis in grasshoppers; hyperpigmentation induced in the appendages of mice by exposure to  $\gamma$  radiation; the toxic effects of  $D_2O$  in mice and rats; the course of deuteration of mice drinking deuterated water; the effects of deuteration on the growth of ascites tumors in mice; the influence of paired doses of  $Co^{60}$   $\gamma$  radiation on recovery from radiation injury; the survival of the four-day chick embryo following irradiation with fission neutrons; metabolism of organic acids by *Spirillum serpens*; the relationship of flick phosphene to eye phenomena; the metabolism of  $Ca^{45}$  and  $Sr^{90}$  in fish; the lack of protective effects of isomers of phenergan against radiation lethality in mice; the calibration of a combination electronic cell counter and size distribution analyzer used in classification of tumor cells in suspension; the biosynthesis of  $C^{14}$ -labeled reserpine and  $C^{14}$ -labeled gibberellins; the metabolic relation between adenine and sulfur amino acids in yeast; and tracer studies on arginine metabolism in rat livers. (For preceding period see ANL-5655.)

**10** ANL-5732

Argonne National Lab., Lemont, Ill.  
BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMI-ANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1957. July 1957. 203p. Contract W-31-109-eng-38. \$5.50(OTS).

Progress is reported in the following studies: the radio-sensitivity of *paramecium*; the sensitivity of germinating tobacco seed to light and x radiation; characteristics of mutants of *Escherichia coli*; the toxicity of  $Sr^{90}$  in dogs and mice; the effects of whole-body x irradiation on liver catalase levels in mice; the biosynthesis of methionine in bacteria; the effect of irradiation on liver tryptophan peroxidase activity in rats; the dissociation of insulin in pyridene-water and acetic acid-water solutions; the development of devices for dispensing microbial cultures rapidly and for counting bacteria automatically; the effect of 3-amino-1,2,4-triazole on intracellular distribution of catalase and uricase in mice livers; biochemical and morphological studies on nuclei from rat livers; electron microscope observations of the protozoan flagellate, *Peranema trichophorum*; the initial radiation syndrome of the pigeon and its effect on blood pressure and renal function; amyloid disease in irradiated and nonirradiated mice; genetic variation in the survival time of mice under daily exposures to  $Co^{60}$   $\gamma$  radiation; the acute radiation response of the chick; the toxic effects of deuterium oxide in rats; the deposition of liver glycogen in x-irradiated guinea pigs; the influence of ultraviolet, x, and  $\gamma$  radiations on pigmentation in mice; an analysis of the mechanisms involved in radiation injury; the metabolism of boron by *Chlorella*; photoperiodism studies on *Xanthium*; the effect of gibberellic acid and photoperiod on indoleacetic acid oxidase in *Lupinus albus*; measurements of the neutron spectrum at the animal exposure position within the gamma-neutron radiation chamber at the CP-5 Argonne research reactor; the effect of single and spaced multiple doses of  $Co^{60}$   $\gamma$  and fission neutron radiation on the incorporation of  $Fe^{59}$  into the rat hematopoietic system; the effectiveness of three radiation qualities on rats in terms of chronic radiation injury and mortality; the survival of giant amoebae after single exposures to  $Co^{60}$   $\gamma$  rays and fission neutrons; the effects of injection of nonirradiated protoplasm on the recovery of irradiated amoebae; the development of a micropipette cutting device for cytological work; factors affecting granulocyte distribution; the effectiveness of injected solutions of the dipotassium salt of rhodizonic acid ( $K_2R$ ) and the tetrasodium salt of tetrahydroxyquinone ( $Na_4T$ ) for increasing the excretion of  $Sr^{85}$  in rats; the secretory activity of tissue mast cells; studies on the effect of deuterium oxide on tumor growth in mice; the development of an automatic scanner for the localization of tritiated compounds in

## REFERENCES

paper chromatograms; the effect of neutron irradiation upon anhydrous  $\text{Na}_2\text{HPO}_4$  and  $\text{Na}_4\text{P}_2\text{O}_7$  in quartz, lime, and boron-free glass tubes; the stability toward x rays of sulfonium compounds as illustrated by *s*-adenosylmethionine; tracer studies employing labeled  $\text{CO}_2$  on the kinetics of glycine metabolism in rat liver; the structural elements of uterine muscles; the preparation of tritium-labeled organic compounds by self-irradiation; the metabolism of alkylmercaptans in yeast; the metabolism of unsaturated fatty acids and cholesterol in rats; the biogenesis and translocation in plants of  $\text{C}^{14}$ -gibberellic acid; and the growth of algae in high concentrations of deuterium oxide. (For preceding period see ANL-5696.)

11

ANL-5841

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMI-ANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1957. Mar. 1958. 204p. Contract W-31-109-eng-38. \$3.50(OTS).

Progress is reported in the following studies: factors affecting the production of antibodies in irradiated rabbits; the effects of irradiation on the serological activity of ovalbumin; factors affecting the growth of transplanted mouse ascites carcinomas in rats; the effects of strontium-90 on the life span and incidence of bone tumors in mice; the effects of irradiation on xanthine concentration and xanthine oxidase activity in chicken liver homogenates; the stability under various biochemical conditions and hydrolysis of *S*-adenosylmethionine; the biosynthesis and use as a growth factor substitute of *S*-adenosylmethionine by yeast mutants; design modifications of the Coulter counter, designed for red blood cells, for use in counting and sizing bacteria; electron microscope observations on fibrillogenesis in the regenerating achilles tendon of normal, scorbutic, and recovering guinea pigs; the response of mice to conditioning doses of whole-body gamma irradiation; the incidence of thymic lymphomas in mice exposed to low-dose daily cobalt-60 gamma irradiation; the relative effectiveness of cobalt-60 gamma rays and fission neutrons for producing duodenal damage in mice; genetic factors affecting tail spotting in mice; the effect of deuterium oxide on kidney function in rats; the influence of the endocrine glands on radio-induced hyperpigmentation in mice; the protective effects of injected bone marrow against radiation injuries in mice; the biological effects of neutrons in the epithermal region from 0.1 to 100,000 ev; the effect of whole-body neutron irradiation on the volitional activity of the mouse; developments in neutron-capture therapy; development of methods for estimating the body burden for various tracer radionuclides; the recovery of irradiated amoebae following injection of non-irradiated protoplasm; tracer studies employing phosphorus-32 in determination of the life span of neutrophils; the antipyretic effects of salicylates and aurintricarboxylic acid; the use of chelating agents in the treatment of manganese poisoning; the tissue distribution and toxic effects following long-term ingestion of deuterium oxide in mice; measurements of the radioactivity of typical foodstuffs after pile irradiation for the purpose of sterilization; the production of heat by the neutron irradiation of boron-free glass, lime glass, and quartz and its effect upon the condensation of phosphate; measurement of calcium-45 by liquid scintillation methods; tracer studies of protein turnover in rat liver; the effects of dietary cholesterol on cholesterol levels and cholesterol ester composition in liver and plasma of rats; and statistical studies of bone tumor death

rates, characteristics of the Argonne National Laboratory population, and inbreeding in the European bison population. (For preceding period see ANL-5732.)

12

ANL-6093

Argonne National Lab., Lemont, Ill.

BIOLOGICAL AND MEDICAL RESEARCH DIVISION SEMI-ANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1958. Dec. 1959. 110p. Contract W-31-109-eng-38. OTS.

Progress is reported in the following studies: the control of a scabies-like mange of rats and pinworms in mice; *in vivo* measurement of  $\text{Sr}^{90}$  in dogs; the effects of the chronic ingestion of  $\text{Sr}^{90}$  in mice; investigation of the tritium labeling of organic compounds by the self-irradiation method; the delayed effects of x irradiation in chickens; development of a new method for the assay of enzymatic activity of various homocysteine transmethylases; the use of a punched-card system for the location of filed prints of electron micrographs; the specific chromosomal control of the mass of the nucleolus and of the cytoplasm in plants; the effect of deuterium oxide on peripheral blood cells in rats; spermatogenesis in irradiated mice; the development of mathematical models for the maintenance and regulation of populations of blood cells of both erythroid and myeloid origin; the effect of boron on the uptake of iron, copper, manganese, and molybdenum in a monocotyledonous plant, the grass *Setaria spacelata*; the photoperiodic behavior of sunflowers; the morphology of the mitotic spindle and chromosomes as seen under the interference microscope; the thirty-day survival of female mice and rats given single whole-body exposures to fission neutrons; the effectiveness of combined therapy with cysteine, bone marrow cells, and streptomycin and of cerbaritol, a bone marrow extract, against radiation injuries in mice; the biological effects of gamma radiation in mice and fission neutrons in chick embryos; modification of the membrane filter technique for studies of radiation effects in bacterial spores;  $\text{Sr}^{85}$  retention by the rat as a function of age at injection; the kinetics of granulocyte production in the normal dog; sedimentation rate studies; the effect of three polyamino acid chelating agents on acute experimental lead poisoning in rats; the treatment of radiostrontium poisoning by means of a diuretic, acetazolamid; the preparation and properties of toxohormone from tumors; the potentiation of tumor radiosensitivity; the fractionation of cholesterol esters by silicic acid chromatography; and the bacterial metabolism of unsaturated fatty acids. (For preceding period see ANL-5916.)

13

(ANL-6264) BIOLOGICAL AND MEDICAL RE-

SEARCH DIVISION SEMI-ANNUAL REPORT, JULY THROUGH DECEMBER, 1959. (Argonne National Lab., Ill.). Dec. 1960. Contract W-31-109-eng-38. 189p.

Progress is reported on the following studies: the possible relationship between environmental  $\text{Ra}^{226}$  and incidence of bone tumors in human populations; the incidence of tumors in mice exposed to chronic  $\gamma$  irradiation; the effects of chronic  $\gamma$  irradiation on histology of testes cells; the effects of periodic exposure to  $\gamma$  radiation on the mortality of guinea pigs; determinations of the density of various mouse tissues; the synthesis of dimethyl formamide (DMF) and uranyl nitrate-DMF; an investigation of the role of the small intestine in acute radiation death in mice following exposure to fast neutrons or  $\gamma$  radiation; the effect of neutron dose on the incidence of mammary tumors and fertility of female rats and mice; measurements of  $\text{Cs}^{137}$  in samples of tea and human milk made with a  $\gamma$  spectrometer; the latency and growth of bone tumors induced by injected  $\text{Sr}^{90}$  in two strains of mice; histopathologic changes

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in the skeleton of mice following injection of various doses of  $Ra^{226}$ ; the development of mathematical models of cellular populations; reaction mechanisms in the response of chicks to radiation injuries; cell generation times in *E. coli*; the demonstration of infective organisms living in the cytoplasm of *A. proteus*; electron microscopic study of the fine structure of fat cells as related to structure; the effects of enzymes on induction of bacteriophage of *E. coli*; lipid metabolism and the isolation, fractionation, and analysis of cholesterol esters obtained during turnover studies; tracer studies on the role of urea in nitrogen metabolism using deuterium-labeled urea in which free energies of formation for deuterio-urea were determined; the participation of metal ions in transmethylation activity of enzymes in microorganisms; the effects of ultraviolet irradiation on yeast cells; the effects of thiol compounds on mitochondrial swelling; the effects of photoperiodism on flowering of xanthium; the effects of concentrations of 30 to 50% of deuterium oxide in drinking water on cells of male reproductive organs in mice and dogs and reproductive potential of male mice; the use of tritiated thymidine as a tracer in cell renewal in acute and chronic myelogenous leukemia; the loss of mutagenic potential in chemostat cultures of *E. coli*; radioinduced recessive mutations in mice; the demonstration of a recessive mutation in *Drosophila*; the pathology of ectromelia (a virus disease) and pseudomonas infections in mice; the effects of x,  $\gamma$ , and neutron irradiation on the formation of bacterial endotoxins in mice; the radioprotective effects of injected protoplasm in amoebae; the effects of chelating agents on the removal of monomeric and polymeric thorium in rats; the relationship of plutonium removal to tumor incidence in mice; the effects of chelating agents on the removal of monomeric and polymeric plutonium in mice; and the use of tritiated thymidine to measure the growth of tumor metastases in mice. A list of publications during the period is included. (For preceding period see ANL-6200.)

- 14 BIOLOGICHESKOE DEISTVIE PADIATSI. VYPUSK 1. (Biological Effects of Radiation. Issue No. 1). Lvov, Publishing House of Lvov University, 1962. 104p.

Thirteen articles are included on radiation effects on growth, development, and metabolism in animal and plant organisms. Biochemistry, cytology, and effects of ionizing radiation in agriculture and crop improvement are also discussed.

- 15 UCRL-3758  
California. Univ., Berkeley. Radiation Lab.  
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR]  
JANUARY, FEBRUARY, MARCH 1957. Apr. 19, 1957.  
37p. Contract W-7405-eng-48. \$0.30(OTS).

Progress is reported in the following studies: the morphology of an osteogenic sarcoma transplantable in rats; the metabolism of  $Ca^{45}$  in an osteogenic sarcoma; the induction of mammary tumors in rats following the injection of  $At^{211}$ ; radioinduced changes in oxygen-saturated pepsin solutions and aqueous glycine solutions; and the development of chemical radiation detectors. Health chemistry problems and health physics activities for the period are summarized. (For preceding period see UCRL-3653.)

- 16 UCRL-3880  
California. Univ., Berkeley. Radiation Lab.  
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR]  
APRIL, MAY, JUNE 1957. July 29, 1957. 33p. Contract  
W-7405-eng-48. \$0.75(OTS).

Data are tabulated on the incidence of and classification of tumors induced in female mice following administration of  $\mu\text{c/g}$  body weight of  $At^{211}$ . Progress is reported in studies on the radiation chemistry of proteins, formic acid, and acetic acid. The effect of dose rate in the radiolysis of aquo-organic systems was investigated. Radiobiological studies reported include back-mutation studies of irradiated yeast, studies of hypothalamic-irradiated rats, the effects of x irradiation on egg hatch and egg-laying in wasps, tracer studies on the rate of formation and life span of lymphocytes, and studies on the embryonic nucleoprotein fraction that stimulates growth in tissue cultures. Health chemistry and health physics activities for the period are summarized. (For preceding period see UCRL-3758.)

- 17 UCRL-8031  
California. Univ., Berkeley. Radiation Lab.  
BIOLOGY AND MEDICINE QUARTERLY REPORT [FOR]  
JULY, AUGUST, SEPTEMBER 1957. Oct. 14, 1957. 19p.  
Contract W-7405-eng-48. \$0.75(OTS).

Data are presented from studies on  $Sr^{90}$  metabolism in monkeys and the deposition of  $Ce^{144}$  in the developing fetal skeleton in rats. Progress is reported in the study of radiation-induced reactions of proteins in aqueous solution. The process of thermal-neutron-induced activation of indium foils was adapted to the measurement of fast neutrons. A radiation survey was made at the 184-inch cyclotron and recommendations were made regarding additional shielding. Routine health chemistry and health physics activities during the period are summarized. (For preceding period see UCRL-3880.)

- 18 UCRL-8265  
California. Univ., Berkeley. Radiation Lab.  
BIOLOGY AND MEDICINE SEMI-ANNUAL REPORT  
[FOR] OCTOBER 1957 THROUGH MARCH 1958.  
Apr. 25, 1958. 65p. Contract W-7405-eng-48. \$1.75  
(OTS).

Data are presented from the following studies: the radiation chemistry of pepsin, gelatin, methanol, benzene, and hexanes; the effects of irradiation of the pituitary in advanced cancer using high-energy particles from the 184-inch cyclotron; applications of ion beams in biological studies; the metabolism of strontium-90 and its relation to calcium metabolism in rats; hematological effects of low-level radiation doses in man; the influence of diet on serum lipoproteins; development of simplified methods for the analysis of blood serum for lipid content; tracer studies employing iron-59 of red blood cell production and destruction and iron metabolism in a wide variety of blood disorders; tracer studies on heart function and blood circulation employing  $I^{131}$ ; applications of  $C^{14}$  in studies of leukocyte formation from which it was concluded that peripheral neutrophils have a 2-day life span, large lymphocytes a life span of 2 to 3 days, and small lymphocytes a life span of between 8 and 14 days; tracer studies employing  $P^{32}$  in studies of the phagocytic action of cells of the reticuloendothelial system; factors regulating the volume of the body fluids; and development of a method for determining estrogen concentration in urine. Radiation protection activities are summarized. Lists are included of reports issued and papers published during the period. (For preceding period see UCRL-8031.)

- 19 UCRL-8513  
California. Univ., Berkeley. Lawrence Radiation Lab.  
BIOLOGY AND MEDICINE SEMI-ANNUAL REPORT

## REFERENCES

[FOR] APRIL THROUGH SEPTEMBER 1958. Oct. 21, 1958. 76p. Contract W-7405-eng-48. \$1.75(OTS).

Data are tabulated from studies of the long-term turnover rates for calcium-45 and strontium-90 in monkeys and rats. Progress is reported in studies on the thyroid uptake and mammary tumor incidence in female rats as a function of dose of injected astatine-211. Data are presented from studies on the radiation chemistry of solutions of pepsin, gelatin, chymotrypsin, yeast dehydrogenase, aqueous acetic acid-oxygen mixtures, oxygen-free formic acid solutions, and glycine-water systems at elevated temperatures. Encouraging results are reported following 340-Mev proton beam or 900-Mev alpha beam pituitary irradiation in patients with breast carcinoma, acromegaly, diabetes mellitus, and other conditions that are under endocrine control through mediation of the pituitary. Laboratory and clinical data indicating the degree of completeness of hypophysectomy are being collected on all patients. Studies were made of the thyroid function of animals subjected to intense alpha-particle or deuteron irradiation of the thyroid area. A method was developed for the separation of iodinated amino acids of the thyroid, and the method applied in tracer studies of the effect of pituitary irradiation on thyroid function in rats. Progress is reported in studies on: the effects of radiation on the permeability of yeast cells to sodium and potassium ions; applications of neutron-activation analysis in determining the constituents in samples of biological materials; the chemical properties and physiological effects of human urinary erythropoietin; the development of analytical methods for the study of blood lipids; the role of heparin in lipid metabolism; the physiological role of lipoproteins in atherosclerosis and relationship to blood pressure and age; the effects of massive doses of a variety of estrogenic substances on the stimulation of liver phagocytic activity; the role of thymus in lymphocyte production; physicochemical studies of yeast metabolism; the effects of pH and anoxia on growth and x-ray sensitivity of *Escherichia coli*; biological measurements of aging of man; and genetic studies on *Drosophila*. Routine radiological monitoring activities are summarized. A list is included of publications and papers presented during the period. (For preceding period see UCRL-8265.)

20 UCRL-8988  
California. Univ., Berkeley. Lawrence Radiation Lab. BIOLOGY AND MEDICINE SEMIANNUAL REPORT FOR APRIL THROUGH SEPTEMBER 1959. Dec. 1959. 91p. Contract W-7405-eng-48. OTS.

Progress is reported in the following studies: the ultrastructure of cells of yeast, diatoms, and Hela as observed with the electron microscope; the effects of pituitary irradiation on human metastatic mammary carcinoma and certain endocrine-controlled diseases, the response of breast cancer patients to changes in endocrine status, and the excretion of urinary estrogens in patients with advanced metastatic mammary carcinoma; the effects of irradiation on the response of isolated nerve fibers; the effects of radiation on phagocytic activity in the reticuloendothelial system; demonstration of a protective effect of intraperitoneally injected olive oil against radiation injury in mice; the physiological effects of transplantation of homologous tissues; biological effects of internally deposited radioisotopes; the incidence of mammary tumors in astatine-211 injected rats; the metabolism of fatty acids in humans; the pathology of atherosclerosis; coronary blood

flow; the effectiveness of human urinary erythropoietin in primates; determinations of protein-bound iodine in blood serum; the role of citric acid in bone physiology and its relationship to calcium metabolism; measurements of radioactivity in man using a whole-body counter; development of an infrared micromethod for serum lipid analysis and methods of gas-phase chromatography employing a strontium-90 radiation detector; the development of a method for the *in vivo* measurement of blood flow to the gastrointestinal tract; investigation of radiation-induced oxidation of aqueous glycine anhydride-oxygen solution and of aqueous protein-oxygen systems; reactions in the radiolysis of aqueous protein systems and in the irradiation of peptides in the solid state. Activities in the fields of radiation detection and protection during the period are summarized. A list is included of reports and papers prepared during the period.

21 HW-47500  
General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.  
BIOLOGY RESEARCH ANNUAL REPORT [FOR] 1956.  
Jan. 4, 1957. 237p. Contract W-31-109-Eng-52. \$1.25 (OTS).

Late in 1956 a reorganization at Hanford disbanded the Radiological Sciences Department and transferred the Biology Section, with its name changed to Biology Operation, to the Hanford Laboratories Operation. Emphasis of the research program changed from being primarily Hanford oriented toward being more concerned with radiobiological problems derived from the general needs of radiation hazard control. Data are presented from the following studies: the effect of age on the absorption and skeletal deposition of  $P^{32}$ ; the effect of dietary Ca on the skeletal deposition of  $Sr^{90}$ ; the pathological effects of ingested  $Ru^{106}$  and  $Cs^{137}$  in rats, and the determination of permissible limits for  $Ru^{106}$  in drinking water; the toxic effects of continued dietary  $I^{131}$  in sheep; the development of a special metabolism cage for swine receiving radioisotopes; determination of the effects of a triple radiation assault in lambs; the effects of  $\beta$  particles on pig skin; the cutaneous absorption of Pu from a  $PuF_4$  solution; the decontamination of animal skin contaminated with Pu by applying a plastic coating to the contaminated area and then pulling it off; the pathological effects of radioactive particles in the lungs of mice; the effect of CaEDTA on the radiosensitivity of yeast; and the uptake of  $Sr^{90}$  by plants from contaminated soil. A list of talks presented at scientific meetings and publications during the period is included. (For preceding period see HW-41500.)

22 (UCRL-9408) BIO-ORGANIC CHEMISTRY  
QUARTERLY REPORT, JUNE, JULY, AND AUGUST 1960.  
(California. Univ., Berkeley. Lawrence Radiation Lab.).  
Sept. 22, 1960. 51p. Contract W-7405-eng-48. OTS.

Controlled experiments to confirm the effect of deuterium and tritium in causing a disjunction in *Drosophila* were carried out. Both deuterium and tritium have an influence, but whether the effect is synergistic or additive is not known. Studies of radiation effects on nucleotides continued with investigation of solvents for chromatography of irradiated nucleotides, analysis for sugars and phosphates, and ultraviolet absorption spectra of irradiated nucleotides. A study on inbred BALB/c mice showed that  $D_2O$  causes sterility in some inbred strains more rapidly and completely than in outbred strains. Research continued on enzyme distribution in rat brain with studies on the determination of hexokinase in rat brain and its relative activity in various areas of the brain and with a comparison of hexoki-

## REFERENCES

nase activity to that of cholinesterase and lactic dehydrogenase. Conclusive proof was obtained that in Papaver somniferum thebaine is the first of the octahydrophenanthrene alkaloids to be formed and is converted by successive o-demethylations to codeine and finally morphine. Brief reports are given of investigations of high-carotenoid particles in spinach chloroplasts, Hill reaction activity of small chloroplast fragments, and factors affecting the permeability of Chlorella cells to metabolites of interest. Preliminary experiments with electron spin resonance measurements in photosynthetic systems are described. Electron transfer was studied in combining halogenated quinones with perylene, N,N,N',N'-tetramethyl-p-phenylenediamine, and N,N-dimethylaniline. A proportional counter was designed for detection of radioactive components in gas chromatography.

- 23** (UCRL-10156) BIO-ORGANIC CHEMISTRY QUARTERLY REPORT, DECEMBER 1961 - FEBRUARY 1962. (California. Univ., Berkeley. Lawrence Radiation Lab. and California. Univ., Berkeley. Dept. of Chemistry). Apr. 3, 1962. Contract W-7405-Eng-48. 89p.

Progress is reported in investigations on the polymerization of formaldehyde, ultraviolet irradiation of aqueous  $\text{HC}^{14}\text{N}$ , radiation chemistry of nucleic acid constituents, oxidation of free sugars and aldonic acid derivatives by Acetobacter suboxydans, preparation and isolation of  $\text{C}^{14}\text{O}_2$  ~ enzyme, metabolism of  $\text{C}^{14}$ -ribulose diphosphate by Nitrobacter agilis,  $\text{C}^{14}\text{O}_2$  metabolism of Hordeum vulgare seedlings during the development of the photosynthetic apparatus, location and chemical characterization of RNA in the chloroplasts of Spinacea oleracea, inhibition of dark bleaching by stroma extracts and by inert gases, ESR studies on chromatophores from Rhodospirillum rubrum and on quantasomes from spinach chloroplasts, and phthalocyanine manganese and etioporphyrin manganese complexes.

- 24** PALEOECOLOGICAL FACTORS IN THE SEA. Ralph Buchsbaum. (Univ. of Pittsburgh, Pittsburgh, Pa.). Annee biol. **33**, 283-5(1957). CA-52: 8398h.

- 25** UCRL-3836  
California. Univ., Berkeley. Radiation Lab.  
CHEMISTRY DIVISION QUARTERLY REPORT [FOR]  
MARCH, APRIL, AND MAY 1957. June 28, 1957. 64p.  
Contract W-7405-eng-48. \$1.25(OTS).

Progress is reported in studies in bio-organic chemistry, nuclear chemistry, and process chemistry. A method was developed for tracer studies with oxygen, using paper chromatography and proton activation of  $\text{O}^{18}$  to  $\text{F}^{18}$ . The procedure was applied in a preliminary study of the path of oxygen in green algae. The construction is reported of a modified design of a  $\text{C}^{14}$  respiration-pattern analyzer for humans. Data are included from preliminary studies using the apparatus. Progress is reported in studies on the luminescence spectrum of chloroplasts immediately after exposure to a flash of light; the radiation chemistry of benzene; the preparation of dry  $\text{KC}^{14}\text{N}$ ; the synthesis of labeled morphine; the demonstration of  $\text{C}^{14}$  respiration pattern abnormalities in diabetic rats; tracer studies on tissue distribution of diisopropylfluorophosphonate in rats; tracer studies on the incorporation of adenine- $\text{C}^{14}$  into nucleotides and nucleic acids in rats; the excretion of cyanide- $\text{C}^{14}$  in mice; tracer studies on fat metabolism;

the effect of  $\gamma$  radiation on photosynthesis and viability of Chlorella; the photosynthesis of lipids and pigments in algae; the radiation chemistry of trichloroethylene; determination of fission yield curves for the deuteron-induced fission of  $\text{U}^{234}$ ,  $\text{U}^{235}$ , and  $\text{U}^{236}$ ; and determination of cross sections for deuteron ( $d, \gamma$ ) reactions in uranium. (For preceding period see UCRL-3710.)

- 26** [RADIATION IN THE LIFE SCIENCES]. Statement of Dr. C. L. Dunham (U. S. Atomic Energy Commission, Washington, D. C.).

Developments in applications of nuclear energy and its byproducts in biology and medicine during the past five years are reviewed. Topics discussed include the development and applications of whole-body radiation counters; the labeling of the thymidine molecule with tritium and applications as a tracer in studies on the production and fate of desoxyribonucleic acid; research in terrestrial ecology, the marine sciences, and the fate of radionuclides in man's environment; the mechanisms by which radiation produces genetic and metabolic effects and induces cancer; and the selective uptake of a variety of radioelements by plant roots and leaves, and the movement of these elements in the soil. Educational and training program development and expansion are also reviewed.

- 27** IODINE-129: ITS OCCURRENCE IN NATURE AND ITS UTILITY AS A TRACER. R. R. Edwards. Science **137**, 851-3(1962) Sept.

- 28** RADIOAKTIVE ISOTOPE IN KLINIK UND FORSCHUNG. III. VORTRAGE AM GASTEINER INTERNATIONALEN SYMPOSION, 1958. (Radioactive Isotopes in Medicine and Research. III. Contributions At The Gastein International Symposium, 1958). K. Fellinger and H. Vetter, eds. Munich-Berlin, Urban and Schwarzenberg, 1958. 371p.

The papers presented at the Third Gastein Conference and the discussions made on each paper are given. The subjects include "Hematological Investigations in the Clinical Application of Radioactive Gold Colloid," "The Effect of Whole Body Irradiation on Bone Marrow as Studied by Radioactive Iron Incorporation," "Affecting the Radioinduced Inhibition of DNA by Cysteine in Normal and Reduced Metabolism," "Use of Isotopes in Clinical Studies of Skeletal Metabolism," "Radiation Dosimetry Aspects of Bone Tumor Production," "Respiration and Fermentation in Cultures of Fibroblasts and HeLa Tumors," "Investigations on the Schizoid Problem with  $\text{C}^{14}$ -labeled d-Diethylaminelysergic Acid and  $\text{C}^{14}$ -labeled Succinic Acid," "Autoradiographic Investigations of Protein Metabolism in the Cells of the Central Nervous System of Rabbits and Rats," "Quantitative Determination of Iodine-Albumin Bonding in Tissues on a Radiohistochemical Basis," "The Kinetics of Blood Purification of Colloidal Suspensions as a Measurement of the Hepatic Circulation," "Studies of Liver Blood Flow in Man," "Radiogold and Bromosulfalein Clearance of Plasma as a Clinical Test of the Liver Function," "The Efficiency of Purification of the Human Liver with Respect to Colloidal Radioactive Gold ( $\text{Au}^{198}$ ). Preliminary Study of a New Technique for the Measurement of the Purification Efficiency," "Measurement of Liver Blood Flow with Colloidal Radiogold ( $\text{Au}^{198}$ )," "Advantage of Radioactive Labeled Substances in Clearance and Distribution Research," "A Method for the Determination of the Absolute Iodine Uptake in the Thyroid Gland and an Indirect Method for the Determination of the Concentra-



## REFERENCES

tion of Inorganic Iodine in the Blood," "Hemodynamics: Interpreted by Means of Multiple Scintillation Detectors Placed Over the Anterior Thoracic Wall," "Diagnostic Value of Selective Quantitative Radiocardiography," "Iron Metabolism Studies in Liver Cell Damage," "Hypophysis and Iron Metabolism: V. Influence of ACTH on Rat Erythropoiesis," "Radioactive Tracer Studies of Red Cell Survival in Tumor Bearing Rats," "Radio Paperchromatographic Investigations on the Specificity of the Bonding of (Co<sup>60</sup>)-Vitamin B<sub>12</sub> Analogs to Intrinsic Factor Concentrates," "The Life Span of Cr<sup>51</sup>-labeled Erythrocytes at Various Ages," "Hypophysectomy for Advanced Breast Cancer Using High Energy Particle Beams—Proton and Alpha Particles," "The Radiological Hypophysectomy by Implantation of Au<sup>198</sup>," "Experiences with Yttrium-90 Hypophysectomy," "Analysis of the Behavior of I<sup>131</sup>-albumin in the Normal Subject and Nephrotic Patient," "A Practical Method for Plasma Albumin Turnover Studies," "Rapid Protein Breakdown in Idiopathic Hypoproteinemia," "Isotope Studies on the Regulation of Muscular Blood Circulation," "Diagnosis of Venous Return Flow Disturbances with Radioiodine Tissue Clearance," "Photo-scanning: A Preliminary Report of a Simplified Graphic Method for the *in vivo* Pre-operative Localization and Recording of Brain Tumors," "Probability of Interest of the External Detection by 'Bremsstrahlung' of Radiophosphorus P<sup>32</sup> in the Organism," "A Comparison of the Tissue Distribution of Colloidal Yttrium-90 and Gold-198 in Mice after Intraperitoneal Injection," and "The Distribution of Radioyttrium and Rare Earths in Organism in Different Application Methods."

**29** RADIOAKTIVE ISOTOPE IN KLINIK UND FORSCHUNG. Band IV. Vorträge am Gasteiner Internationalen Symposium 1960. (Radioactive Isotopes in the Clinic and in Research. Volume IV. Proceedings of the Gastein International Symposium, 1960). K. Fellinger and R. Höfer, eds. Munich-Berlin, Urban & Schwarzenberg, 1960. 393p.

Thirty four papers and the discussions following each are compiled. The papers were limited to the following subjects: (1) investigations of calcium metabolism and the location of bone tumors with Ca and Sr isotopes; (2) new methods of therapy with radioactive isotopes; (3) investigations on the structure of erythrocytes by *in vivo* measurements; (4) determination of the electrolyte content of the body and electrolyte exchange, as well as determinations of the total body and extracellular waters; (5) investigations of glucose and insulin metabolism by means of radioisotopes; and (6) the peripheral metabolism of thyroid hormones and iodated amino acids.

**30** ISOTOPIC TRACERS. A Theoretical and Practical Manual for Biological Students and Research Workers. Second Edition. G. E. Francis, W. Mulligan, and A. Wormal. London, University of London, 1959. 544p.

A theoretical and practical manual on the use of isotopes in biochemical and physiological investigations is presented. The manual gives up-to-date and reliable data with regard to the physical characteristics of radioactive isotopes and radiations, the types of apparatus and equipment available, and the experimental techniques used in the biological isotope tracer field.

**31** ELECTRON DISTRIBUTION IN SOME HIGH-ENERGY PHOSPHATES AND TRANSFER OF ENERGY FROM CATABOLISM TO ANABOLISM. Barbro Grabe.

(Univ. Stockholm). *Biochim. et Biophys. Acta* 30, 560-9(1958)(in English). CA-53: 6318i.

**32** HEAVY WATER INHIBITION OF CELL DIVISION: AN APPROACH TO MECHANISM. P. R. Gross and W. Spindel. *Ann. N. Y. Acad. Sci.* 90, 500-22(1960) Oct. 7

**33** (ORO-358) FINAL SCIENTIFIC REPORT ON [MEDICAL APPLICATIONS OF RADIOISOTOPES]. P. F. Hahn (Meharry Medical Coll., Nashville). July 12, 1960. 42p. Contract AT(40-1)-269.

Results are summarized on 560 patients with malignant disease treated with radiogold or silver-coated radiogold colloids. Observations made in the course of the therapeutic management of chronic leukemias are included. It was concluded that a single intravenous administration of radiogold colloid offers as simple and satisfactory a method of treating leukemia as is available at this time. Results are reported from preliminary studies in dogs on the therapy of bronchogenic tumors. Attempts to induce tumors of the lung in dogs are reported. Studies are reported on the control of lymphatic drainage after pneumonectomy by the injection of silver-coated gold colloid. Experiences in the treatment of advanced bronchogenic carcinoma with radioactive colloids administered by the intrabronchial route are reported. Results are reviewed from long-term studies on the effects of Fe<sup>59</sup> and Fe<sup>55</sup> in dogs; intracavitary therapy with radiocolloids; the treatment of pleural effusions with silver-coated Au<sup>198</sup> colloids; the treatment of leukemia in mice with radioactive gold colloids alone and combined with other agents; tracer studies of phagocytic processes in the animal body; the distribution of gold in the central nervous system following the administration of radioactive colloidal gold; the tolerance to intraventricular injections of colloidal gold and to injections directly into the brain; the feasibility of nerve destruction by the intraneural and perineural injection of large doses of high specific activity radiogold colloids; the treatment of prostate and bladder carcinoma with radioactive gold; the development of cirrhosis and ascites in dogs following administration of colloidal radioactive gold; studies of protein deficiency in dogs which received chronic massive internal irradiation due to intravenous administration of radiogold; the prophylactic use of radiocolloids postoperatively to prevent seeding of cancer; studies of hepatic visualization following the administration of colloidal radiogold; studies on palladium colloids with antigenic protective colloid in an attempt to concentrate antigen in the reticuloendothelial system; and miscellaneous studies. A list is included of 76 publications resulting from this contract.

**34** HW-53500  
General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.  
HANFORD BIOLOGY RESEARCH ANNUAL REPORT  
FOR 1957. Jan. 10, 1958. 227p. Contract W-31-109-Eng-52. \$3.50 (OTS).

Data are presented on the uptake, distribution, and turnover of radioelements in plants, animals, and communities; the biological effects of ionizing radiations on certain organs and organisms; and the effects of operations at Hanford on plant and animal life of the region. Factors that affect radiostrontium uptake and deposition

## REFERENCES

in plants and animals were investigated, with special emphasis on the effects of calcium. Data are included from studies on the permissible limits for  $Cs^{137}$ ; the uptake of  $I^{131}$  by plants and animals; permissible limits for plutonium in drinking water; the hazards from the deposition of radioactive particles and factors affecting their removal; the mechanisms by which ionizing radiations cause biological effects; the effects of reactor effluent on plants and animals; and measurements of the concentration of radioelements from reactor effluent absorbed by plants and animals. (For preceding period see HW-47500.)

### 35 ORNL-2384

Oak Ridge National Lab., Tenn.

HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JULY 31, 1957. Nov. 26, 1957. 131p. \$3.50(OTS).

Progress is reported in the following studies: the construction of a body burden counter which employs activation analysis to measure directly  $U^{235}$  injected in rats and mice; the tissue distribution of  $U^{233}$  in mice following ingestion of 0.12  $\mu$ c/day in drinking water for periods of from 30 to 120 days; the testing of an atmosphere exposure chamber; the tissue distribution of U in dogs following inhalation of uranium fumes or the ingestion of uranium oxides; development of a procedure for the radiometric determination of U in urine following ion exchange separation as a uranyl chloride complex; radiobiological-ecological studies on the drained bed of White Oak Lake, an impoundment used as a holdup basin for low-level radioactive wastes; the development of procedures for use in the collection of arthropods and insects; the effects of irradiation on population growth of *Collembola*, *Coleoptera*, and *Caloglyphus*; the uptake of fission product waste seepage by trees and smaller vegetation; a review of data on maximum permissible concentrations of radioisotopes for the human body; the tissue distribution of  $Sr^{90}$  and  $Y^{90}$  in mice; the spectrographic analysis of human tissues for trace elements; the performance of an aerosol generator for dispersing U aerosols; the development of radiochemical methods for the determination of trace amounts of fission products in water and soil samples; investigations of waste processing by evaporation, storage in deep wells and waste pits, adsorption on soil columns; solvent extraction, and sintering; assays of the soil movement and dilution of wastes from storage pits; and a survey of possible waste disposal sites. A review is presented of the Ichiban Project for the determination of the absorbed doses of fast neutrons and  $\gamma$  radiation received by survivors of the nuclear bombing of Hiroshima and Nagasaki. Data are included from a preliminary study of  $\gamma$  attenuation by Japanese house components. Applications of the information theory in studies of radioinduced tissue damage are discussed. A quantum theory for the dielectric constant of metals is presented and discussed. A procedure is described for the preparation of thin uniform sources for a beta-ray spectrometer. Studies on the theoretical physics of radiation dosimetry and the development of instruments for use as dosimeters are reported. Education, training, and consultation activities during the period are reported, and a list of publications during the period is included. (For preceding period see ORNL-2151.)

### 36 HW-54938

General Electric Co. Hanford Atomic Products

Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES QUARTERLY

PROGRESS REPORT [FOR] OCTOBER-DECEMBER 1957. J. W. Healy, ed. Feb. 12, 1958. Decl. May 12, 1958. 43p. Contract W-31-109-Eng-52. \$6.30(ph OTS); \$3.00(mf OTS).

Progress is reported in the following studies: the effects of reactor effluent on aquatic organisms inhabiting the Columbia River; the effect of small daily doses of  $I^{131}$  on developing swine fetuses; the effect of dietary calcium levels on the uptake of  $Sr^{90}$  by lambs; the distribution of intravenously injected  $Zr^{95}$  in rats and cattle; the effects of treatment with diethylenetriamine pentaacetic acid on the bone absorption of plutonium in experimental animals; fission product metabolism in plants and animals; the effects of whole-body irradiation on gastrointestinal function in rats; the pathological effects of irradiated intestinal homogenates when injected intraperitoneally into normal rats; the distribution of inhaled or intratracheally administered particles of  $Ru^{106}O_2$ ,  $Pu^{239}O_2$ , and  $Sr^{90}SO_4$  in mice and dogs; the demonstration of malignant lung tumors in mice following the intratracheal administration of  $Pu^{239}O_2$ ; the diffusion and transport of stack gases at distances up to eight miles from continuous ground sources; modifications in design and performance checks of radiation detection instruments for monitoring and dosimetry; the development of chemical dosimeters; and studies on ground waste disposal, the gelling of liquid wastes, and the flow of ground waters in the area. (For preceding period see HW-52866.)

### 37 HW-46333

General Electric Co. Hanford Atomic Products

Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] July-September 1956. J. W. Healy, ed. Oct. 30, 1956. Decl. Oct. 2, 1958. 31p. Contract W-31-109-Eng-52. \$4.80(ph OTS); \$2.70(mf OTS).

Reorganization of Hanford Atomic Products Operation with the elimination of the Radiological Science Department as a separate organizational entity is reported. Organizational structure of the new Hanford Laboratories Operation is outlined. Progress is reported in the following studies: a radiobiological-ecological survey of the Columbia River; the effect of reactor effluent on aquatic organisms; the effect of nutritional state on thyroidal uptake of  $I^{131}$  in swine; the  $I^{131}$  concentration in fetal thyroids in sheep during various stages of gestation; the effects of whole-body x irradiation on the leukocyte count in sheep; the transfer of radiostrontium to sheep milk following oral ingestion; Pu absorption and metabolism in young rats; fission product absorption and metabolism in rats; radiation injury to the exteriorized intestine of rats; the pathological effects of radioactive particles deposited in the lungs of mice; factors affecting the uptake of fission products by plants; the genetic effects of  $S^{35} \beta$  particles in the growth media of yeast; the radiobiological monitoring of the Columbia River; the monitoring of reactor effluent water; development of a tentative procedure for the determination of the rare earth group in reactor effluent water; investigations in the development of chemical dosimeters; meteorological studies on particle diffusion and transport in which fluorescent particles were used as tracers to study the growth of a smoke plume in both the vertical and horizontal directions; development of an instrument employing a scintillation counter to measure Pu concentration in wounds of the hands; and the development of instruments for neutron dosimetry and an  $\alpha$  air monitor.

## REFERENCES

38

HW-55586

General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE  
FIELD OF RADIOLOGICAL SCIENCES. Quarterly  
Progress Report for January-March 1958. J. W.  
Healy, ed. Apr. 3, 1958. Decl. Oct. 13, 1958. 47p.  
Contract W-31-109-Eng-52. \$7.80(ph OTS); \$3.30  
(mf OTS).

The toxicity of reactor effluent under changing concentrations which may occur in the Columbia River as a result of fluctuating river flows when power is produced by Priest Rapids Dam was re-evaluated with young salmon. Data are tabulated. The effect of radioactive elements on aquatic organisms was studied on rainbow trout which were fed  $P^{32}$  for 24 weeks. Progress is reported on studies of the effects of small, chronic doses of  $I^{131}$  in sheep and swine; strontium metabolism in lambs and miniature pigs using  $Sr^{89}$  and  $Sr^{90}$  as tracers; the tissue distribution of plutonium in miniature pigs and rats; the effect of dietary calcium level and duration of exposure period on the deposition and retention of  $Sr^{90}$  and  $Ca^{45}$  in rats; the tissue distribution of  $Zn^{65}$  in rats; the histopathological effects of radiation on the intestinal tract; the effect of x irradiation on the DNA content and DNA synthesis in the intestinal tract; the tissue distribution and solubility in body fluids of inhaled radioactive particles; the uptake of radioactive substances by plants; the uptake of  $Cs^{137}$  and  $Zn^{65}$  by aquatic plants and animals; field studies employing fluorescent pigment tracers on the airborne concentrations of materials emanating from the reactor areas; and the development of an empirical system for forecasting probable trajectories of particles in the atmosphere. Literature surveys were made on measurements and data on ranges and stopping powers of charged particles. The testing of a slow neutron ionization chamber in a moderated neutron detector indicates the possibility of providing fixed monitors to integrate the fast neutron dose at working locations. Operation of the rock-shield body monitor is reported. Studies of the geology, hydrology, and soil characteristics of the region were continued with refinement of the techniques involved so that the parameters involved in ground waste disposal can be better defined. (For preceding period see HW-54938.)

39

HW-56928

General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE  
FIELD OF RADIOLOGICAL SCIENCES QUARTERLY  
PROGRESS REPORT [FOR] APRIL-JUNE 1958. J. W.  
Healy, ed. July 28, 1958. 41p. Contract W-31-109-  
Eng-52. \$1.25(OTS).

A test was made to determine the effect of changing concentrations of reactor effluent in the Columbia River on young Chinook salmon. Data are tabulated. Progress is reported in the following studies: the effects of chronic ingestion of low-level iodine-131 in sheep and swine; tracer studies on strontium metabolism in swine and rats; the effects of various treatments on the absorption and tissue distribution of plutonium; the effects of dietary calcium levels on strontium-90 bone deposition in rats; and the absorption and metabolism of fission products in rats. The fate and toxicity of inhaled radioactive materials were studied in mice. Data are included for particles containing plutonium-239, ruthenium-106, iodine-131, and strontium-90. Increased

genetic effects were observed from phosphorus-32 metabolized by yeast cells when compared with the effects from phosphorus-32 in the medium surrounding the cells. Data are included from studies on the effects of soil conditions on the uptake of strontium-90 by plants. Results are reported from routine radiobiological studies and environs monitoring activities. A study was made of the formation of radioisotopes in reactor effluent water, and an analysis was made of reactor film material removed from two process tubes by purging with a chemical cleaner. Fluorescein dye was used in studies of ground water flow. Laboratory investigations were conducted to obtain data for waste disposal studies. (For preceding period see HW-55586.)

40

HW-57908

General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE  
FIELD OF RADIOLOGICAL SCIENCES. Quarterly  
Progress Report [for] July-September 1958. J. W.  
Healy, ed. Oct. 15, 1958. 36p. Contract W-31-109-  
Eng-52. \$1.25(OTS).

No definite pathological damage was observed in fish fed 0.006  $\mu$ c and 0.06  $\mu$ c phosphorus-32 per gram body weight per day, although a reduction in growth rate occurred at the 0.06  $\mu$ c level. Pathological damage was evident at the lethal feeding level of 0.6  $\mu$ c. Damage to the gastrointestinal tract involved all segments with equal frequency and ranged from mild damage to the epithelium at three weeks to severe damage and breakdown of the mucosa after 15 weeks. Pathological changes were also observed in the kidneys, liver, and spleen. Progress is reported in the following studies: the effects of chronic ingestion of low levels of iodine-131 in sheep and swine; the tissue distribution of single oral doses of strontium-90 in swine; blood volume determinations in swine of various ages and weights; the retention of a single dose of strontium-90 and calcium-45 in mature rats as influenced by the total calcium level of the diet; the tissue distribution of zinc-65, tungsten-185, and phosphorus-32 in rats, with emphasis on the relatively high radiation dose from phosphorus-32 in the ovary when compared to bone; the pulmonary deposition and development of lung tumors in mice following intratracheal administration of ruthenium-106; the effectiveness of various aerosol treatments in removing  $Ru^{106}$   $O_2$  particles from the pulmonary tract; the effect of variation in the strontium-calcium ratio on uptake of strontium-90 and calcium-45 by plants; the uptake of zinc-65 by plants irrigated with undiluted reactor effluent; radiobiological monitoring of the Columbia River and environs; the measurement of the vertical profiles and of the integrated cross-wind concentrations of airborne tracer materials used in diffusion and transport studies; routine monitoring activities; detailed duplicate activation analyses of the various materials which could contribute to the radioisotope level in the reactor effluent water; a test of the ability of a column of aluminum turnings to remove radioisotopes from reactor effluent; determinations of the radiation-protective ability of various anionic groups in aqueous solutions; a survey of surface features of the basalt bedrock beneath the Hanford waste disposal area; ground waste disposal studies; and fission product volatility studies. (For preceding period see HW-56928.)

## REFERENCES

41 HW-58833

General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE  
FIELD OF RADIOLOGICAL SCIENCES. Quarterly  
Progress Report [for] October–December 1958. J. W.  
Healy, ed. Jan. 12, 1959. 38p. Contract W-31-109-  
Eng-52. \$1.25(OTS).

Data are tabulated from studies on the metabolism and toxicity of fission products in rainbow trout and other fish. The effects of added dietary calcium on the uptake, retention, and transfer of strontium-90 and calcium-45 were studied in ewes, lambs, swine, and rats. Preliminary data are reported. Initial data are included from a study of the additive effects of external radiation and plutonium deposited in the body. The therapeutic effectiveness of DTPA was found to be superior to other chelating agents tested for the removal of plutonium in rats. Additional data are presented on the effect of age on zinc-65 absorption in rats. Gastrointestinal radiation injury is described in rats maintained on drinking water containing various doses of yttrium-90. Erioglaucine showed a protective effect against radiation injuries in mice. Progress is reported in studies on the following: biological effectiveness of beta particles from phosphorus-32, sulfur-35, and tritium on plants; the metabolism of fission products by plants; the transfer of fission products in an aquatic environment; studies on the concentration of beta emitters in small fish; tracer studies on the dispersion of airborne materials from stack effluent; the improvement of instruments for radiation dosimetry; the completion and testing of a body monitor for the direct measurement of radioisotopes in the bodies of people; an investigation of the contribution of reactor effluent to radioactivity of Columbia River water; the development of analytical procedures for the determination of antimony-122, antimony-124, iron-59, scandium-46, and scandium-47 in reactor effluent water or irradiated reactor cooling system materials; the determination of zirconium-95 and niobium-95 in mixtures of the two isotopes using a liquid scintillation coincidence spectrometer; the development of colorimetric dosimeter solutions; the drilling and closed-circuit television examination of test wells; research in soil physics and soil chemistry; and ground waste investigations. (For preceding period see HW-57908.)

42 HW-60137

General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE  
FIELD OF RADIOLOGICAL SCIENCES. Quarterly  
Progress Report [for] January–March 1959. J. W.  
Healy, ed. Apr. 23, 1959. 36p. Contract W-31-109-  
Eng-52. \$1.25(OTS).

Comparative studies of calcium and strontium metabolism and the influence of calcium content of the diet on strontium uptake indicate a lack of similarity in behavior between these two ions. Progress is reported in the following studies: the effect of strontium-90 and yttrium-90 on rainbow trout; the effects of the chronic ingestion of small doses of iodine-131 in sheep; the gastrointestinal absorption of orally administered strontium-90 in miniature swine; the effectiveness of various treatments in the therapy of radioinduced skin lesions; the absorption and metabolism of plutonium and the effects of DTPA on the deposition of plutonium in bone; the effects of the chronic ingestion of stron-

tium-90 and calcium-45 in young rats; the effects of age on the absorption and retention of zinc-65 in rats; the long term effects of ingested yttrium-90 on the intestine; the radioprotective effects of erioglaucine in rats; the presence of lymphosarcomas in the intestinal mesentery of mice exposed to  $\text{Pu}^{239}\text{O}_2$  atmosphere; the deposition and translocation of  $\text{Pu}^{239}$  following inhalation of  $\text{Pu}^{239}\text{O}_2$  in dogs; the distribution of iodine-131 in sheep following exposure to iodine-131 vapor and silver iodide-iodine-131 aerosol; the radiosensitivity of yeast cells; the uptake of cesium-137 and strontium-90 by bean plants; a comparison of the quantities of the fission products, zirconium-niobium-95, cesium-137, cerium-141, and cesium-praseodymium-144 in plants and animals collected from various habitats with the amount of rainfall; the radiobiological monitoring of the Columbia River; modifications in personnel monitoring instruments; the completion of a whole-body monitor; the installation and testing of radiotelemetry equipment; investigations relative to detection techniques; a study of the process of adsorption and subsequent erosion of isotopes in reactor process tube film; geological and hydrological studies of the Hanford area of interest in problems of waste disposal; investigations on the immobilization of radioisotopes in waste solutions; the effectiveness of commercial anion exchange resins for removing plutonium from waste solutions; a review and analysis of information on fuel element rupture debris released to the Columbia River; and the release of fission products from heated low-level irradiated unclad uranium. (For preceding period see HW-58833.)

43

ATOMIC RADIATION DANGERS AND WHAT THEY  
MEAN TO YOU. H. W. Heckstall-Smith. London,  
J. M. Dent & Sons, Ltd., 1958. 112p.

The hazards associated with natural radiation, industrial, medical, and research radiation, atomic and thermonuclear weapon explosions, and atomic plant operations are discussed.

44

(NP-11928) HUMAN INTERNAL RADIOISOTOPE DOSIMETRY, INSTRUMENTATION, PROPHYLAXIS AND THERAPY. Annual Progress Report, July 1, 1961–June 30, 1962. Robert M. Heyssel and George R. Meneely (Vanderbilt Univ., Nashville. School of Medicine). June 30, 1962. Contract DA-49-007-MD-995. 84p.

Preliminary experiments with  $\text{Zr}^{95}$ – $\text{Nb}^{95}$  and  $\text{Ba}^{140}$ – $\text{La}^{140}$  were used to determine the body burden and organ concentrations in rats. The biological half time for  $\text{Ba}^{140}$ – $\text{La}^{140}$  was about seven days. Most of the remaining nuclide was in the bone. Equations were derived to determine the amount of  $\text{Ba}^{140}$ – $\text{La}^{140}$ ,  $\text{Zr}^{95}$ – $\text{Nb}^{95}$ , and  $\text{Ru}^{103}$ – $\text{Rh}^{103m}$  in the human body using data obtained by whole-body counting techniques. Computer programs to process the data and to provide rapid determination of counting rates under photopeaks of any isotope counted in the steel room were developed. Concentration of intraperitoneally administered  $\text{Cs}^{137}$  in rats was greatest in gastrocnemius muscle with decreasing concentrations in ilium, kidney, stomach, liver, heart, spleen, lung, and brain. In the Radioactivity Survey  $\text{Cs}^{137}$  burdens in 659 persons were significantly higher in the white race than in the Negro and in males than in females. Other studies included weekly measurements of  $\text{Cs}^{137}$  burdens in ten normal subjects, data analysis of potassium content in people, total body potassium during therapy in essential hypertension, isotope labeled Vitamin B<sub>12</sub> in normal and abnormal subjects, wholebody counting techniques

## REFERENCES

for the determination of absolute absorption of iron,  $^{131}\text{I}$  accumulation in human thyroid tissue during 1962 U.S.A. nuclear weapon testing, and  $\text{C}^{14}$  5-hydroxytryptamine platelet survival.

45

BIBLIOGRAPHY ON THE BIOLOGICAL EFFECTS OF THORIUM. E. Hutchinson. (U. S. Atomic Energy Comm.) Jan. 18, 1960. (UR-563) (p.1-47)

46

(STI/DOC/10/4) IAEA RESEARCH CONTRACTS FIRST ANNUAL REPORT. Technical Reports Series No. 4. (International Atomic Energy Agency, Vienna). 1961. 31p.

Summaries are included of research contracts which expired prior to Dec. 31, 1960. The contracts were concerned with investigations of: electrophysiological responses of biological systems in nerve cells to irradiation with small doses of ionizing radiations; the mode of the protective action of certain sulfhydryl compounds against radiation effects on the synthesis of deoxyribonucleic acid, using tritium-labeled thymidine; development of a bubble chamber method of monitoring and dosimetry for low fast neutron fluxes; effects of incorporated radioisotopes on the stability of genetic materials; interrelation of root and leaf absorption of radioisotopes in herbaceous plants; uptake of radioactive wastes by lowland rice from soils contaminated by irrigation water, and decontamination of the rice; and comparison between mutation rates induced by acute and chronic gamma irradiations.

47

ACRH-7  
Argonne Cancer Research Hospital, Chicago.  
SEMIANNUAL REPORT TO THE ATOMIC ENERGY COMMISSION. Leon O. Jacobson, ed. Mar. 1957. 88p. Contract AT-(11-1)-69. \$0.50(OTS).

Progress is reported in studies on the biological effects of deuterium in mice; the effects of injected cell suspensions on the development of cataracts in irradiated mice; tracer studies on the metabolism of progesterone during pregnancy; tracer studies on cholesterol metabolism and steroid synthesis; development of a test for the determination of taurine in urine; the validity of using tritium self-radiation labeling in biochemical tracer studies; the preparation of labeled digitoxin by the tritium self-radiation method; studies on the tissue distribution, excretion, and placental transfer of radioactive digitoxin in human beings; and the feasibility of counting double-labeled compounds of tritium and  $\text{C}^{14}$  using a liquid scintillation counter with a two channel pulse height analyzer. Results are included from a theoretical study of the effect of variables on the shape of the electron energy spectrum and beam current of the ACRH linear electron accelerator. (For preceding period see ACRH-6.)

48

ISOTOPIC TRACERS IN BIOLOGY. AN INTRODUCTION TO TRACER METHODOLOGY. Martin D. Kamen. New York, Academic Press Inc., 1957. 485p.

Applications of stable and radioactive isotopes in biological research are reviewed. Related chemical, physical, and biochemical applications and methodology are discussed. Numerous concrete examples illustrating work with tracers are included. 124 references.

49

A/CONF.15/P/860  
Argonne National Lab., Lemont, Ill.; Argonne Cancer Research Hospital, Chicago; Suburban Cook County Tuberculosis Hospital-Sanitarium, Hinsdale, Ill.; and Chicago. Univ.

THE BIOLOGY OF DEUTERIUM. J. J. Katz, H. L. Crespi, A. J. Finkel, R. J. Hasterlik, J. F. Thomson, W. Lester, Jr., W. Chorney, N. Scully, R. L. Shaffer, and Sung Huang Sun. 17p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

That replacement of hydrogen by deuterium has far-reaching consequences for living systems has long been noted, but the full scope and nature of these effects still remain largely unexplored. Early work was greatly hampered by the difficulties of obtaining deuterium but the development of a vast nuclear energy technology has made deuterium available on a large scale. It has now become opportune to undertake comprehensive studies on the biology of deuterium, and this paper reports work undertaken on algae, fungi, bacteria, and mammals. Mice will tolerate up to about 40 per cent  $\text{D}_2\text{O}$  in the drinking water for at least four months; during this period the body water reaches a stable value of about 30 per cent heavy water. When deuteration is continued for long periods, deuterium is incorporated into various tissues and organs to the amount of from 40 to 50 per cent of the deuterium in the body fluids. Mice have been maintained in a deuterated state, up to 25 atom per cent, for as long as 12 months without obvious effects, although there are some indications that fertility is adversely affected. The basis of the biological effects of deuteration is the kinetic isotope effect. In general, bonds to deuterium react less readily than bonds to hydrogen; in consequence, reaction rates are decreased, and a depression in tissue metabolism should result. At concentrations above 30 atom per cent deuterium mice and rats show weakness, neuromuscular hyperexcitability, bradycardia, and eventually, stupor and death. Since neoplastic cells metabolize rapidly, presumably these should be particularly sensitive to the effects of deuteration. Deuteration of host mice resulted in reduced growth rates of injected Krebs-2 ascites tumors and of inoculated P-1534 lymphatic leukemia. The general effects of deuterium on growth have been studied in algae and fungi. Two species of algae, *Chlorella vulgaris* and *Scenedesmus obliquus*, have been successfully cultured in nutrient media containing 99.6 per cent  $\text{D}_2\text{O}$ . Growth rates are inhibited, but algae have been harvested that yield water of combustion containing more than 90 atom per cent deuterium. The morphology, pigmentation and granulation of the algae were altered by deuteration. The fungi *Penicillium notatum* and *Aspergillus fonsecaeus* have been grown in media containing various concentrations of  $\text{D}_2\text{O}$  up to 99.6 per cent, and here, too, morphology, sporulation, pigment production, and growth rate were all affected by deuteration. The results obtained with algae clearly indicate the feasibility of producing fully deuterated compounds of biological significance by biosynthetic procedures. Bacterial studies on Group C hemolytic streptococci, Type I pneumococci, *Mycobacterium tuberculosis* and *M. phlei*, and *Escherichia coli* showed that the growth rates were diminished with elevation of the  $\text{D}_2\text{O}$  concentration above 50 per cent and that cessation of growth uniformly occurred at  $\text{D}_2\text{O}$  levels greater than 90 per cent.

## REFERENCES

Deuterium may also be utilized in the study of metabolism by the administration of deuterated essential metabolites. Experiments are described wherein fungi have been grown on glucose in which the hydrogen on carbon-1 (D-glucose-d<sub>1</sub>) has been completely replaced by deuterium.

**50** CHEMICAL AND BIOLOGICAL STUDIES WITH DEUTERIUM. Joseph J. Katz. *Am. Scientist*, 48: 544-80 (Dec. 1960).

A basic flowsheet is presented for the production of deuterium oxide by the H<sub>2</sub>O/H<sub>2</sub>S dual-temperature exchange process. Cost factors are discussed. The physical properties of H<sub>2</sub>O and D<sub>2</sub>O are compared. It is shown that the substitution of hydrogen by deuterium in water gives rise to marked changes in physical properties. Applications of deuterium in chemical and biological studies are reviewed. Topics discussed include kinetic isotope effects of deuterium compounds; reaction rate phenomena which are known to exhibit isotope effects; the deuterium isotope effect in living systems; the growth of algae in heavy water; a comparison of ordinary and deuterated algae; the isolation of deuterated chloroplast pigments and other fully deuterated compounds from algae; photosynthesis in deuterated green algae; deuterium isotope effects on mammals; deuterium isotope effects on tumor growth; and the preparation of compounds in which hydrogen is replaced by deuterium.

**51** A/CONF.15/P/1029

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOSTRONTIUM-CALCIUM RELATIONS IN PLANTS AND ANIMALS. H. A. Kornberg. 12p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

In laboratory experiments the uptake in plants of Strontium-90 was measured as a function of calcium in the root environment. In general, the uptake of Sr<sup>90</sup> was not found to decrease as a result of the calcium present. When rats were intraperitoneally injected or fed in single doses mixtures of Sr<sup>90</sup> and calcium, the deposition of Sr<sup>90</sup> on the skeleton was not found to be affected by the presence of calcium in the administered dose. Groups of rats which were maintained on diets containing several levels of calcium along with Ca<sup>45</sup> and Sr<sup>90</sup> were found to deposit less Sr<sup>90</sup> and Ca<sup>45</sup> on their skeletons as the calcium in the diet was increased. However, the decrease of Sr<sup>90</sup> deposition with increase in dietary calcium was less than that which would have occurred if the strontium had deposited in inverse proportion to the calcium in the diet. The data also showed that beyond 0.5% of dietary calcium there was no further decrease of Sr<sup>90</sup> deposition with increase of calcium. Similar observations were made with lambs that were fed Sr<sup>90</sup> and calcium gluconate in milk. The gluconate ion was found to account for a significant amount of the decreased Sr<sup>90</sup> deposition observed. These experimental observations point to the need for measuring Sr<sup>90</sup> contamination in absolute units and tend to support theoretical considerations of the effect of isotopic dilution. The movement and deposition of substances can occur by only four processes: flow, diffusion, adsorption, and chemical reaction. Each of these processes may be separately considered to determine the effect of the addition of one isotope on the movement or deposition of another isotope. For the processes of flow and simple diffusion, isotopic dilution is without effect. For the processes of adsorption and chemical

reaction, isotopic dilution will be effective only under the condition that some acceptor material upon which the element deposits approaches saturation. Even under this condition the effect of one isotope on another need not be a linear inverse relationship. Experimental data involving radioactive and non-radioactive isotopes other than radiostrontium and calcium which also support these hypotheses are presented.

**52**

DEUTERIUM IN BIOLOGY. D. Kritchevsky. *Ann. N. Y. Acad. Sci.* 84, 575(1960) Nov.

**53**

DEUTERIUM ISOTOPE EFFECTS IN CHEMISTRY AND BIOLOGY. David Kritchevsky, ed. *Ann. N. Y. Acad. Sci.*, 84: 573-781(Nov. 25, 1960).

Twenty-one papers are presented. One paper not abstracted includes a brief discussion on deuterium in biology. Nine papers were previously abstracted in *NSA*. Separate abstracts have been prepared for the remaining eleven papers.

**54**

THE APPLICATION OF RADIOISOTOPES IN BIOLOGY. A. M. Kuzin (International Atomic Energy Agency, Vienna). Review Series, Developments in the Peaceful Applications of Nuclear Energy. No. 7. 63p. (1960). (STI/PUB/15/7). (In Russian and English)

This survey of the ways in which radioisotopes are used in biology will give the reader an idea of the most promising trends in the use of this new method of investigation in the various branches of biology. It is based on work published in 1959 and illustrates the application of radioactive tracers to biochemistry, plant and animal physiology, microbiology and immunology, histomorphological research, hydrobiology, entomology, ichthyology, genetics, and other biological disciplines, and gives a complete picture of the use of isotopes in biology. A bibliography of 570 references is attached, covering articles, books, and monographs in which the reader can find information about the ways in which radioactive isotopes are used in biological research and for practical economic purposes.

**55**

BIOLOGICAL STUDIES ON CALCIUM, STRONTIUM, LANTHANUM, AND YTTRIUM. D. Laszlo. (Montefiore Hosp., New York, N.Y.). *Proc. Intern. Conf. Peaceful Uses Atomic Energy, Geneva, 1955* 10, 62-7(Pub. 1956). CA-52-5613c.

**56**

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. PART I. Johannes Meissner. *Kerntechnik* 2, 91-5(1960) Mar. (In German)

A survey of the application of radioisotopes in biology and medicine considers first the indicator method and then irradiation techniques. In this first part, as an example, some biological questions were discussed which could be examined in detail by the application of isotopic tracers. Distribution studies in an organism and metabolism studies were treated in this connection. (tr-auth)

**57**

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. [PART] II. Johannes Meissner (Forschungsinstitut, Borstel, Ger.). *Kerntechnik* 2, 126-31(1960) Apr. (In German)

## REFERENCES

The properties of radioactives which affect the planning, carrying out, and evaluation of tracer studies are reported. In addition to the biochemical reactions which must be followed with the tracers, the selection must be determined from physical factors as half life, type and energy of radiation, specific activity, carrier, and isotope effect. The effect of these factors on the measurement techniques was considered. Regulations for the tracer dose and the measurement magnitudes are given. The applicability of stable isotopes as tracers is discussed.

58

RADIOACTIVE ISOTOPES IN BIOLOGY AND MEDICINE. [PART] III. Johannes Meissner (Forschungsinstitut, Borstel, Ger.). Kerntechnik 2, 163-6(1960) May. (In German)

The application of radioisotopes in radiotherapy is discussed. The methodic possibilities given are explained in comparison with x-ray therapy. The units for radiation dose and absorbed dose are introduced, and the conclusions for the applicability of various radiation types are described. The application methods offered for therapeutics are outlined and illustrated by an example. The application of sealed preparations which are used in body cavities and tissues and open preparations, especially in the selective irradiation method, is discussed.

59

RADIOISOTOPES IN ANIMAL AND PLANT BIOLOGY. Orsini F. F. Nicola. Fac. agron. y vet., Univ. Buenos Aires, Escuela agron., Bull. No. 35, 98p. (1958). (In Spanish)

Chapters are included on the fundamentals of nucleonics and radiation, radiation effects and isotope applications, radioisotopes in animal physiology and veterinary medicine, and radioisotopes in the plant kingdom.

60 ORINS-34

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn. OAK RIDGE INSTITUTE OF NUCLEAR STUDIES MEDICAL DIVISION REPORT FOR 1959. 87p. Contract AT-40-1-GEN-33. OTS.

Studies associated with whole-body irradiation followed by attempts at bone-marrow grafts in acute leukemia patients were continued. Data were compared with results reported by other workers. Results are reported from studies on the effects of both whole-body and local-port irradiation on various hematological diseases, other clinical syndromes, and normal hematopoietic tissues. It was demonstrated that large doses of whole-body irradiation alone can produce remissions in leukemia. Results are reported on a group of patients who received autologous bone marrow grafts after a single large dose of nitrogen mustard. Clinical results are reported on a group of eleven patients with acute or subacute leukemia given a single large dose of whole-body irradiation, varying from 200 r to more than 900 r, followed by intravenously administered bone marrow from homologous donors cross matched for the usual major blood types. A summary is included of current impressions of the treatment of leukemia by irradiation and marrow grafting. Pathological changes following whole-body irradiation are discussed. Results are reported from clinical studies on 8 men exposed to whole-body radiation 9 months previously during the Y-12 accident. A comparison is made in data on the Y-12 patients and data on the Yugoslavian accident victims. Procedures

for the recovery of amino acids from solutions are discussed and data are tabulated on daily variation in levels of urinary amino acids, and the effects of whole-body irradiation or nitrogen mustard on urinary excretion of amino acids. Research with internal isotopes was continued and progress is reported in the development of scanning equipment and in interpretation of results. Teletherapy treatments were given to 64 patients suffering from lymphomas of several types. Summaries are included of experimental work on the properties and localization by linear scanning of calcium-47 in rats; the distribution of radioactive colloidal yttrium in rats; selective irradiation by the intralymphatic injection of radioactive preparations; metabolism of rare earths; and liver-liquid response to radiocerium. The design and calibration are described of a whole-body irradiator employing 8 cesium-137 teletherapy machines. New designs and design modifications are described for equipment for scanning and radiation therapy. A training program is outlined. A list of publications during the period is included.

61 HW-41026(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RADIOLOGICAL SCIENCES DEPARTMENT RESEARCH AND DEVELOPMENT ACTIVITIES QUARTERLY PROGRESS REPORT [FOR] OCTOBER - DECEMBER 1955. H. M. Parker. Jan. 11, 1956. Decl. with deletions Feb. 26, 1957. 33p. Contract W-31-109-Eng-52. \$4.80(ph OTS); \$2.70(mf OTS).

Progress is reported in the following studies: a radiobiological-ecological survey of the Columbia River; the toxic effects of continuous low-level exposure to  $I^{131}$  in pigs; Pu metabolism in miniature pigs and rats; the tissue distribution and retention of  $Ru^{106}$  and Cs in rats and mice; the radiosensitivity of the intestine of rats; the pulmonary absorption of radioactive particles and the pathological effects of such particles in the lungs of mice; the uptake of  $I^{131}$  and other fission products from the soil and from air by plants; determinations of the relative biological effectiveness for yeast cells of  $Po^{210}$   $\alpha$  particles and  $P^{32}$   $\beta$  particles; the development of chemical and radiological monitoring methods for studies of radioactive contamination, temperature, and concentration of non-radioactive toxic materials in waste streams, soil, ground water, and air; the separation of fission products from waste streams; and improvements in instruments for monitoring and low-level radiation counting. The status of the research programs of the department is reviewed. (For preceding period see HW-39624.)

62

PROBLEMS OF RADIOBIOLOGY. II. DISTRIBUTION AND TOXICOLOGY OF HEAVY ELEMENTS: URANIUM AND THORIUM. Ferdinando Passalacqua. (Univ. Freiburg, Ger.). Ricerca sci. 27, 1531-8(1957). CA-53: 2299h.

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IMPORTANCE OF RADIOISOTOPES IN VETERINARY MEDICINE. M. V. Plakhotin and A. D. Belov. (Vet. Acad., Moscow). Veterinariya 35, No. 8, 61-4(1958). CA-53:3428e.

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PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER-13 SEPTEMBER 1958. VOLUME 23.



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EXPERIENCE IN RADIOLOGICAL PROTECTION. Geneva, United Nations, 1958. 461p. \$14.50.

New developments in radiation protection and recovery are reviewed. Topics discussed include developments in experimental therapy, methods for the assessment of biological contamination, radiation in the natural environment, experience in radiological protection and the control of radiation hazards, the evaluation of radiation hazards, the development of instruments for the detection of contamination, and the treatment of internal contamination.

### 65 UCLA-195 (Del.)

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING MARCH 31, 1952. Apr. 1, 1952. Decl. with deletions Mar. 7, 1957. 71p. Contract AT-04-1-GEN-12. \$12.30(ph OTS); \$4.50(mf OTS).

Progress is reported in medical research studies.

### 66 UCLA-379

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 30, 1956. Oct. 1, 1956. Decl. Mar. 6, 1957. 148p. Contract AT-04-1-GEN-12. \$22.80(ph OTS); \$7.20(mf OTS).

Progress is reported in the following studies: the synthesis and analysis of unsaturated fatty acids; the effects of whole-body x irradiation on the blood plasma Fe level in rabbits; an evaluation of the effect of quinoxaline 1:4-di-N-oxide on the survival time of irradiated mice; the effect of acute and chronic intravenous infusions of Dextran in irradiated rabbits; investigations of tracer techniques in liver function tests, kidney function tests, and thyroid function tests; the effect of pre-treatment with sodium salicylate on radiation mortality in mice; the skeletal deposition of  $Y^{91}$ ,  $Ca^{45}$ , and  $S^{35}$  in rats following bone fracture; factors affecting the gastrointestinal absorption of  $Sr^{90}$ ; the causative organisms in mouse bacteremias induced by x irradiation; the radiosensitivity of tobacco mosaic virus; effects of irradiation on lipoproteins in embryonic serum; routine monitoring and waste disposal activities; the analysis of human bone samples for Sr content; improvements in the performance of electron microscopes; the performance of chemical radiation detectors when used as dosimeters; factors affecting the uptake of fission products by plants and animals; the accumulation and persistence of radioactive fall-out material in samples of soils, vegetation, animal tissues, and milk collected at various sites and at various times; and a review of soil sampling and processing procedures for radiometric analysis. (For preceding period see UCLA-371.)

### 67 UCLA-386

California. Univ., Los Angeles. Atomic Energy Project. QUARTERLY PROGRESS REPORT FOR PERIOD ENDING DECEMBER 31, 1956. Jan. 1, 1957. Decl. Mar. 14, 1957. 124p. Contract AT-04-1-GEN-12. \$18.30(ph OTS); \$6.00(mf OTS).

Progress is reported in the following studies: the induction of leukemia in mice following injection of a cell-free extract; biochemical studies of leukemic cells; the isolation of ribonucleic acid from yeast; methods for the complete analysis of the fatty acids of tissues or organs; the synthesis and analysis of unsaturated fatty acids; the effects of total-body irradiation on the 5-hydroxytryptamine level in

rats; the effect of irradiation on the blood serum Cu and Mg level in burros; the tissue distribution of Dextran in irradiated rabbits; the development of tracer methods for testing liver function, kidney function, thyroid function, and general metabolism; a comparison of physical, chemical, and biological methods for x radiation dosimetry; mechanisms of bone deposition of  $Y^{91}$ ,  $Ca^{45}$ , and  $S^{35}$ , and  $Sr^{90}$  in rats and rabbits; effects of irradiation on porphyrin compounds; the production and isolation of an antibiotic agent; studies on the late effects of x irradiation on rats; routine health physics activities; the development of chemical radiation dosimeters for medical use; the development of a vacuum tube model of a time-of-arrival-of-fall-out-indicator; the metabolism of Ca and Sr in vertebrates; the redistribution of Pu in soil of a previously contaminated area; and an evaluation of sampling methods for the determination of  $\alpha$  air concentration. (For preceding period see UCLA-379.)

### 68 HW-62638

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

QUARTERLY PROGRESS REPORT ON RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, JULY-SEPTEMBER 1959. Nov. 5, 1959. 38p. Contract AT(45-1)-1350. OTS.

Progress is reported in the following studies: the effect of fission products in reactor effluent on young rainbow trout; the pathological effects of iodine-131 in laboratory animals; determinations of the body burdens and effects on gonads of cesium-137 and zinc-65; the pathological effects of plutonium-239; the effects of age and DTPA therapy on plutonium toxicity in rats; the uptake of fission products by plants; monitoring of beta radioactivity in Columbia River fish; studies on meteorological dispersion using fluorescent pigment tracer particles; the development of radiation monitoring instruments; measurements of radioactivity in reactor effluent; ground waste investigations; environmental monitoring activities; and experiments on the oxidation of uranium and volatilization of fission products. One hundred thirty-six people were measured at the Shielded Personnel Monitoring Station. Results are discussed. (For preceding period see HW-61247.)

### 69 HW-63643

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

QUARTERLY PROGRESS REPORT ON RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, OCTOBER-DECEMBER, 1959. Jan. 25, 1960. 37p. Contract AT(45-1)-1350. OTS.

Passage through a bed of aluminum turnings lowered the concentration of radiophosphorus in reactor effluent water. No difference in the mortality rate was observed in experimental and control groups of rainbow trout given intramuscular injections of strontium-90-yttrium-90, but gastrointestinal damage resulted when trout were fed the same levels of strontium-90-yttrium-90. Progress is reported in studies on the transfer of strontium-85 across gill membranes in fish; the effects of deposited phosphorus-32 on survival and reproduction in fish; the biological effects of the chronic ingestion of small amounts of iodine-131 in swine; the effects of the chronic ingestion of small amounts of strontium-90 by swine on the blood picture of the offspring; the distribution of phosphorus-32 in the tissues of mice as demonstrated by counting with the whole-body mouse counter; the absorption and metabolism of plutonium in rats and swine in which a defi-



## REFERENCES

nite relationship was shown between body burden of plutonium and survival time following irradiation; the metabolism of strontium-90 and calcium-45 in rats; the pathology of gastrointestinal radiation injury and the use of polyvinylpyrrolidone labeled with iodine-131 as a diagnostic aid in the estimation of intestinal radiation injury; the evaluation of hazards from inhaled plutonium oxide; the effects of x radiation on the permeability of yeast cells; the radiobiological monitoring of the Columbia River and environs; and the uptake of strontium-90 and cesium-137 by plants from contaminated soils. Phosphorescent zinc sulfide was used as a tracer in studies on the effects of meteorological conditions on the diffusion of particulate matter. A new system was developed for reading the amount of zinc sulfide. An analysis was completed on the data from 169 subjects given routine examinations in the Shielded Personnel Monitoring Station. Results for potassium and cesium were similar to those obtained with other whole-body counters. Investigations were made of the quantities of zinc-65 in human subjects, water, and foodstuffs and the route of transfer of zinc-65 to humans. It was found that zinc-65 in oysters and other sea food may be responsible for occasional high body burdens found in people. Investigations of techniques and experimental instrument development work were continued during the period. Problems involved in neutron dosimetry and field and personnel monitoring were investigated. Studies were continued on the deposition of particles on duct walls. Results indicate the importance of the velocity of air through the duct and of the particle diameter. (For preceding period see HW-62638.)

### 70 JPRS(NY)-899

RADIOBIOLOGY IN THE USSR. Translation of Abstracts of Articles from Selected Soviet Periodicals. 19p. OTS.

Abstracts are presented of articles from selected Soviet periodicals dealing with applications of radiation and radioisotopes in biology and medicine. Topics covered include hematological research, the effect of hypothermy on the living organism, a tracer study of the role of chemosynthesis in the production of silt deposits and bacterial slimes in reservoirs, the metabolism of strontium-89 in rats, and various other tracer studies on metabolism in rats.

### 71 KAPL-997

Knolls Atomic Power Lab., Schenectady, N. Y. RADIOLOGICAL DEVELOPMENT ACTIVITIES IN THE HEALTH PHYSICS UNIT. Semiannual Progress Report [for] January-June 1953. Changed from OFFICIAL USE ONLY June 3, 1957. 33p. Contract W-31-109-Eng-52. \$6.30(ph OTS); \$3.00(mf OTS).

The calibration of the constant air monitor used to detect  $Kr^{85}$  emanating from the Separations Process Operations was completed. An average detection efficiency of 1.1% and an absorption factor of 0.7 were determined from three series of analyses. The efficiency of Special Materials Shop air-cleaning unit in the collection of submicronic particles under specific operating conditions is reported. Recommendations to increase the efficiency are made. The collection efficiency, as a function of particles size, for air-cleaning and air-sampling filter media is reported for a face-velocity range of 0.5 to 100 cm/sec. The minimum collection efficiencies for the particle size and face-velocity ranges were investigated. The average absorptions of alpha and beta activity in the Hollingsworth and Vose-70 filter media for a series of analyses were 63 and 24%, respectively. Liquid waste studies during the period in-

clude the investigation and recommendation of a proportional sampler for combined sewer effluents and adsorption studies of fission-product activity on the Mohawk River sediment. A discussion of the metering and sampling system for the liquid waste discharged into the Mohawk River is included in this report. The adsorption of fission-product activity on Mohawk River sediment with respect to contact time, laundry detergents, dissolved solids, and the quantity of river sediment was investigated and the data are tabulated. A vegetation analysis for radioruthenium was investigated, and a tentative calculation of the maximum permissible concentrations of activity in vegetation was made. A preliminary substitute for the Sigma Pile was constructed to permit routine and low dose-rate range thermal and slow neutron calibrations. Formulas to determine the integrated dose due to the rain-out and fall-out of activity from a fission-product cloud have been developed and are discussed.

### 72 (ANL-6297) RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT, JULY THROUGH DECEMBER 1960. (Argonne National Lab., Ill.), Feb. 1961. Contract W-31-109-eng-38. 133p.

Data are presented from studies on the total  $Ra^{226}$  content, radon retention, and activity of hotspots in human bones approximately 30 yr post-administration of Ra. Preliminary results are reported from a study of the incidence of bone tumors following injection of  $Pu^{239}$ ,  $Ra^{226}$ ,  $Sr^{90}$ , or  $Ca^{45}$  in mice. Calculations were made of the radiation dose from hotspots formed in bone by these radioisotopes. The  $\gamma$  spectra of 20 subjects who contained known quantities of  $K^{42}$  were obtained with several different sized NaI(Tl) crystals located at various points around the body. These spectra were analyzed to determine the variations in counting rates that resulted with each patient-crystal arrangement. The total-body  $\gamma$  spectra of 12 unexposed employees were measured with the human spectrometer over a span of 30 mo. Data are tabulated on  $Co^{137}/K^{40}$  ratios. The response of a scintillation counter to  $\gamma$  radiation as a function of incidence angle was measured. Studies were made on the refractive index of selected optical media. Improvements were made in the design and in the scintillator solvent for a twin scintillation fast neutron detector. Measurements were made of the skeletal and soft tissue content of Ra in normal humans whose primary source of Ra was food. Calculations of the half lives and distributions of stable Pb and  $Pb^{210}$  in the human body are discussed. Meteorological studies reported include a comparison of observed plume rise of stack effluent with values obtained from well-known formulas, towing tank studies of horizontal turbulent air flow, and soil temperature studies.

### 73 HW-23332

Hanford Works, Richland, Wash. RADIOLOGICAL SCIENCES DEPARTMENT RESEARCH AND DEVELOPMENT ACTIVITIES FOR OCTOBER-DECEMBER 1951. Quarterly Progress Report. Jan. 24, 1952. Decl. Feb. 20, 1957. 30p. Contract W-31-109-Eng-52. \$4.80(ph OTS); \$2.70(mf OTS).

Progress is reported on research and development activities in biology and biophysics. Data are included from the radiobiological ecological survey of the Columbia River, a study of the effects of pile effluent water on aquatic organisms, a study of the absorption of Pu from the gastrointestinal tract, Pu toxicology studies, the effect of growth on the deposition of tissue-bound T, pulmonary absorption of T, effects of radiation on plant life and translocation of

## REFERENCES

radioelements in plants, the retention of bound T oxide by the bean plant and T fixation by bacteria. The toxicology of  $^{131}\text{I}$  was investigated in sheep and some findings are included.

### 74 ANL-5679

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1956. Feb. 1957. 106p. Contract W-31-109-eng-38. \$0.55(OTS).

Data are presented from the following studies: the radiation chemistry of xylene; fabrication of a teflon container for scintillating solutions; factors affecting the concentration of Rn in the atmosphere; a comparison of experimental results with theoretical computations of  $\gamma$  radiation *in vivo* and activity of excreta on a human accidentally contaminated with  $\text{Th}^{227}\text{Cl}_4$  through a puncture wound; operation of a human spectrometer; *in vivo* measurements of the body burden of  $\text{Sr}^{85}$ ,  $\text{Te}^{129}$ , and  $\text{Ra}^{226}$  in human subjects; the development of photomultiplier tubes; the preparation and performance of positive ion sources; tracer studies on the bone deposition of Ce and Tm in dogs; development of procedures for the study of  $\beta$  particle activity employing thick bone section autoradiograms; the preparation and physical properties of  $\text{Ba}^{133}$ ; studies on background counting rate; the drift velocity of electrons in gases; the development of a multiple exposure photographic technique for studying atmospheric diffusion; and an investigation of automatic data processing methods for use with continuously operating meteorological equipment. A list of publications and a summary of staff activities during the period are included. (For preceding period see ANL-5596.)

### 75 ANL-5755

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT FOR JANUARY THROUGH JUNE 1957. July 1957. 86p. Contract W-31-109-eng-38. \$2.25(OTS).

Progress is reported in the following studies: the autoradiographic mapping of the deposition of  $\text{Ca}^{45}$  in cortical bone in dogs; measurement of fission-product activity present in soil; factors affecting the performance of ionization chambers; calibration tests on the dibutyl phosphate method of isolating  $\text{Th}^{228}$  from solutions of ashed bone; microradiographic demonstration of changes in mineral density in dog bones; radiometric determination of radon in bone and in the atmosphere; changes produced in xylene by exposure to massive doses of  $\text{Co}^{60}$   $\gamma$  radiation; applications of the human spectrometer in *in vivo* measurements of  $\text{Cs}^{137}$  build-up in humans; determinations of  $\text{Cs}^{137}$  atmospheric content as a function of time; development of a tracer method using  $\text{K}^{42}$  for measurement of exchangeable potassium in humans; determinations of the radium body burdens in former dial painters; and the atmospheric diffusion of stack particles. A meteorological model towing tank is described which was constructed as an alternative to a wind tunnel for model studies of atmospheric turbulent diffusion. Preliminary studies employing the apparatus are described. (For preceding period see ANL-5679.)

### 76 ANL-5829

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1957. Feb. 1958. 230p. Contract W-31-109-eng-38. \$5.50(OTS).

Progress is reported in the following studies: effects of various doses of gamma radiation on the light ab-

sorbance of aerated and air-free samples of xylene; the design of a light piping system for a scintillation spectrometer; the development of a simple source of monoenergetic fast neutrons and the possibility of using a spherical moderator to produce a roughly monochromatic distribution of neutrons from a source of monochromatic neutrons of a higher energy; calculation of the body retention and elimination of  $\text{Ra}^{228}$  and  $\text{Ra}^{224}$  following a single injection of  $\text{Th}^{232}$ ; the analysis of gamma-ray spectra by the method of least squares; application of a microradiographic technique in determinations of the mineral density of human bones at various ages, and density values for old bone and new growth in bones from man, dogs, mice, cows, rabbits, and rats; the bone deposition of  $\text{Ca}^{45}$  following injection in dogs; determinations of the natural  $\text{Ra}^{226}$  content of 200 water samples from Illinois municipal water supplies; attempts to estimate the fraction of the stratospheric  $\text{Sr}^{90}$  in the total  $\text{Sr}^{90}$  transported to the ground by rain by observing variations in the relative amounts of  $\text{Sr}^{89}$ ,  $\text{Sr}^{90}$ , and  $\text{Ba}^{140}$  in water from a series of rain-falls; the monitoring of the atmosphere for fall-out; design of a transportable gamma-ray spectrometer; soil temperature studies; the operation of an automatic data processing system for use with the soil temperature measurements; measurements of atmospheric radon; wind-tunnel studies on dispersal patterns of stack gases; and application of a meteorological model towing tank for studies of turbulent diffusion in the atmosphere. A list is included of articles published and accepted for publication during the period. (For preceding period see ANL-5755.)

### 77 ANL-5919

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMIANNUAL REPORT [FOR] JANUARY THROUGH JUNE 1958. Sept. 1958. 143p. Contract W-31-109-eng-38. \$2.75(OTS).

Progress is reported in the following studies: factors influencing the dose-effect relationship of absorbance in gamma-irradiated xylene; an examination of computed values of electron drift velocity and energy distribution function in gases; measurements of the natural neutron and gamma-ray dose rates, using a twin liquid scintillation fast neutron spectrometer; the development of a simple source of monoenergetic fast neutrons; calculations of the body burden and dose rate to bones from internally deposited radium-226 and radium-228; calcium-45 tracer studies on the effect of parathyroidectomy on haversian remodeling of bone; calcium-45 tracer studies on the diffusion of calcium in bone crystallites; the effect of oxygen on ion current measurements in argon; development of a method for determining the strontium-90 content of ashed bone by the solvent extraction of its daughter yttrium-90; the determination of actinium-228 as a method for the determination of its parent radium-228 in water samples; calculations of the stratospheric strontium-90 fall-out; measurements of the concentration of radium-226 in Illinois municipal water supplies; an investigation of the source of background counts in  $\text{NaI}(\text{Tl})$  crystals; performance data for a 9.5 by 5-inch crystal detector; the effect of meteorological variables upon the vertical and temporal distributions of atmospheric radon; tracer studies of particle diffusion in isothermal and stably stratified water; and atmospheric diffusion studies in which a smoke stack, an aerial camera, a photogrammetric analyzer, and IBM-650 computer were used to determine the ability of

## REFERENCES

the lower atmosphere, in various meteorological states, to diffuse materials released into it and to determine the physical processes involved in diffusion. (For preceding period see ANL-5829.)

78 ANL-5967

Argonne National Lab., Lemont, Ill.

RADIOLOGICAL PHYSICS DIVISION SEMI-ANNUAL REPORT [FOR] JULY THROUGH DECEMBER 1958. May 1959. 223p. Contract W-31-109-eng-38. \$3.50(OTS).

Progress is reported in the following studies: the decay time of irradiated scintillation solutions; the performance of twin scintillation detectors for measuring neutrons in the presence of gamma radiation; the measurement of cosmic ray neutron background with a twin scintillation fast neutron spectrometer; the diffusion and absorption of gases in plastic-walled ionization chambers; calculations of the drift velocity and the energy distribution of electrons of helium, neon, argon, and nitrogen under the action of a uniform electric field; the development of equipment for tracer studies of atmospheric diffusion; the deposition and retention of isotopes of actinium, radon, radium, and thorium in bone; the effects of age on calcium metabolism in bone; the development of a mathematical theory of the retention of radioactive elements by bone; the development of a reproducible method for directly determining individual alpha activities in mixtures; the design of a flow-gas Geiger counter; a survey of the natural radioactivity of a number of municipal water supplies; measurements of activity in individuals by means of the human spectrometer; measurements of the cesium-137 content of human subjects; measurements of the atmospheric content of cesium-137 as a function of time; a comparison of background radioactivity at the Laboratory and a site approximately 250 feet below grade level; development of a spectrometric method for measurements of radioactivity in soil; the effects of meteorological variables on the distribution of radon in the atmosphere; and studies of atmospheric diffusion. A list of publications during the period is included. (For preceding period see ANL-5919.)

79

Inter-American Nuclear Energy Commission, Washington, D. C. and Argentina. Comisión Nacional de Energía Atómica, Buenos Aires.

RADIOISOTOPES AND RADIATION IN THE LIFE SCIENCES. 2ND INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BUENOS AIRES, 1959. 1960. 275p.

Separate abstracts were prepared on 36 papers presented at this symposium.

80 HW-61247

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] April-June 1959. July 20, 1959. 42p. Contract AT(45-1)-1350. OTS.

Progress is reported in the following studies: the toxicity of chronically ingested strontium-90, radium-226, and plutonium-239 in miniature swine; the effects of temperature and radiation on the incidence of bacterial infection from *C. columnaris* among fish in the Columbia River; atmospheric diffusion in stable conditions; standardization of circuits for use in various types of radiation survey instru-

ments; the determination of the chemical form of isotopes present in reactor effluent water; the use of aluminum turnings to remove isotopes from the effluent water; geology and soil physics of the Hanford plant area; and the deposition of air-borne particles of plutonium from production plant exhaust air. (For preceding period see HW-60137.)

81 HW-64945

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES, QUARTERLY PROGRESS REPORT, JANUARY-MARCH 1960. Apr. 27, 1960. 37p. Contract AT(45-1)-1350. OTS.

Data are reported from the following studies: the effect of reactor effluent on the development of young salmon; the toxicity of  $\text{Sr}^{90}$ - $\text{Y}^{90}$  orally administered to trout; the pathological effects of various amounts of  $\text{Sr}^{90}$  orally administered to miniature swine; the efficacy of tourniquets in preventing transfer from plutonium-contaminated wounds in swine; the fetal uptake, internal dosimetry, and transfer of  $\text{Zn}^{65}$  to colostrum and milk in gestating ewes; the effects of chelating agents on the excretion of plutonium in rats; the effect of chronic ingestion of  $\text{Y}^{90}$  in rats; the deposition of  $\text{Pu}^{239}\text{O}_2$  particles in the lungs of dogs; the effect of tritium and x rays on the growth of yeast cells; and factors affecting the uptake of  $\text{Sr}^{85}$ ,  $\text{Ca}^{45}$ , and  $\text{Zn}^{65}$  by plants. Results are reported from studies on the effect of meteorological conditions on particle diffusion and transport, in which  $\text{ZnS}$  was used as a tracer to distances of 8 to 16 miles from the source. A complete integrated-monitoring-system proposal was written for future development work concerning all types of radiological instrumentation and methods of data obtaining, transmitting, and recording. Data are presented on the diffusion coefficients of  $\text{Cs}^{137}$  in clinoptilolite from a  $\text{CsCl}$  solution and the effects of accompanying ion on adsorption of  $\text{Sr}^{85}$  on calcareous soil. (For preceding period see HW-63643.)

82 (HW-66306) RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report, April-June 1960. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Aug. 5, 1960. 40p. Contract AT(45-1)-1350.

Progress is reported in the following studies: the toxic effects of fission products in reactor effluent on the development of fish; the toxic effects of  $\text{Sr}^{90}$  fed to miniature swine; the response of skin to intradermal injections of plutonium nitrate; the response of irradiated miniature swine to transplants of fetal hematopoietic cells and adult bone marrow; the effects of chelating agents on the absorption of injected plutonium in swine; the mechanisms involved in gastrointestinal radiation injury; factors affecting the deposition of plutonium dioxide in the lungs of dogs; the toxic effects of inhaled plutonium dioxide in dogs; the radiosensitivity of yeast cells; the uptake of  $\text{Sr}^{85}$ ,  $\text{Ca}^{45}$ , and  $\text{Cs}^{137}$  by plants; levels of fall-out radioactivity in plants and animals collected at Cape Thompson, Alaska, during 1959; the concentration of  $\beta$ -emitting radioisotopes in wild animals from the Hanford area; studies on the diffusion and transport of dust particles using fluorescent tracer particles; the development of design modifications in equipment for use in personnel and environment monitoring programs; the performance of a whole-body radiation monitor; the formation of reactor effluent radioisotopes by the reactions  $\text{Al}^{27}(n,\alpha)\text{Na}^{24}$ ,  $\text{Fe}^{54}(n,p)\text{Mn}^{54}$ , and  $\text{Fe}^{58}(n,\gamma)\text{Fe}^{59}$ ; the mechanism responsible for the production of  $\text{Sc}^{45}$  in aluminum reactor process tubes; the effectiveness of alum flocs in removing arsenic from

## REFERENCES

river water; effectiveness of ion exchange materials for the separation of  $\text{Na}^{24}$ ,  $\text{Zn}^{65}$ ,  $\text{Np}^{239}$ , and  $\text{Cr}^{51}$  from water; the geology of the Hanford area; the effectiveness of sampling wells in monitoring the water in an aquifer; the influence of solution pH on anion replacement reactions in soil; laboratory research to characterize the soil chemistry of rare-earth elements; mineral fixation of high-level wastes; parameters controlling the deposition of particles in conduits due to turbulent diffusion; and the efficiency of filters in removing air-borne fission products. (For preceding period see HW-64945.)

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## CELL PHYSIOLOGY

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COMPARATIVE STUDY OF THE KINETICS OF CELLULAR PROLIFERATION OF NORMAL AND TUMOROUS TISSUES WITH THE USE OF TRITIATED THYMIDINE. I. DILUTION OF THE LABEL AND MIGRATION OF LABELED CELLS. R. Baserga and W. E. Kisielski. *J. Nat. Cancer Inst.* 28, 331-9(1962) Feb.

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EFFECTS OF HISTOLOGIC AND HISTOCHEMICAL PROCEDURES ON THE INTENSITY OF THE LABEL IN RADIOAUTOGRAPHS OF CELLS LABELED WITH TRITIATED COMPOUNDS. R. Baserga and W. E. Kisielski. *Lab. Invest.* 12, 648-56(1963) June.

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PERMEABILITY OF ERYTHROCYTES TO LABELLED PHOSPHORUS IN VARIOUS HEART DISEASES. B. S. Berezovskii. *Kardiologia* 2, 82(1963) Mar.-Apr. (Rus)

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ACTION OF TRITIATED THYMIDINE ON THE CLONAL

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cycle. The oxidation of exogenous acetate promotes the oxidation of the yeast's endogenous substrates. The 2:4 DNP prevents oxidation of the radioactive acetate and promotes oxidation of the endogenous substrates which are tagged during the oxidation of the former. The 2:4 DNP selectively inhibits the incorporation of radioactive acetate into citric acid and thus inhibits the operation of the citric acid cycle.

164

GROWTH RESPONSE TO Co-60 GAMMA-IRRADIATION OF HUMAN CELL LINES CULTIVATED IN VITRO. II. STABLE CHANGE IN RADIORESISTANCE OF HeLa STRAIN CELLS MANIFESTED THROUGH REPEATED IRRADIATION. K. Takano, Y. Hirokawa, M. Asano, Y. Amenomori, K. Michi. *Jap. J. Med. Sci. Biol.* **15**, 19-27 (1962) Feb.

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THE USE OF TRITIATED THYMIDINE FOR MARKING MIGRATORY CELLS. J. P. Trinkaus and Marcie C. Gross (Yale Univ., New Haven). *Exptl. Cell Research*, **24**: 52-7(June 1961). (In English)

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167

CHEMICAL COMPOSITION OF RIBONUCLEIC ACID (RNA) AND SPECIFIC ACTIVITY OF NUCLEOTIDE CONSTITUENTS LABELED WITH PHOSPHORUS IN CULTURED VIRUS-INFECTED CELLS. Gian Luigi Turco (Univ. Turin, Italy). *Minerva nucleare* **1**, 181-4(1957). CA 53-9447d

168

A/CONF.15/P/323

PREPARATION OF TRITIUM-LABELED THYMIDINE AND ITS USE FOR THE STUDY, BY THE RADIOAUTOGRAPHIC METHOD, OF THE SYNTHESIS OF DE-OXYRIBONUCLEIC ACID IN CELLS BEING CULTURED. W. G. Verly, H. Firket, and G. Hunebelle (Univ. of Liège). 10p.

The biosynthesis of desoxyribonucleic acid was studied in chicken fibroblasts. Autoradiograms were made of tissues following culture in a medium containing tritium-labeled thymidine. Incorporation of labeled thymidine in the nucleus precedes mitosis by about 7 hours and coincides statistically with the increase in quantity of desoxyribonucleic acid in the nucleus as measured by Feulgen's test. At the time of division, the newly formed desoxyribonucleic acid is distributed equally between the two sets of chromosomes that are to form the nuclei of the daughter cells. After three days of contact with tritium-labeled thymidine, there remain some nuclei that are not labeled. These nuclei do not seem to participate in the mitotic cycles; the technique employed shows no synthesis of des-

oxyribonucleic acid. There is no turnover of such nucleic acid, nor exchange of its thymidine fraction.

169

EFFECT OF CALCIUM IONS ON THE BINDING OF CHROMIUM-51 TO ERYTHROCYTES IN VITRO. G. von Ehrenstein and B. Zacharias (Univ. Stockholm). *Nature* **182**, 1384-5(1958). CA 53-8217g

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VITAMIN B AND PROTEIN BIOSYNTHESIS. III. VITAMIN  $B_{12}$  COMPLEX: NATURE OF THE INCORPORATION ENZYME PRESENT IN CELL SUPERNATANT LIQUID. S. R. Wagle, Ranjan Mehta, and B. Connor Johnson. (Univ. of Illinois, Urbana). *Arch. Biochem. Biophys.* **72**, 241-3(1957). CA-52-3063f.

171

TURNOVER OF NUCLEIC ACIDS IN A NONMULTIPLYING ANIMAL CELL. J. W. Watts and H. Harris (Univ. Oxford, Engl.). *Biochem. J.* **72**, 147-53(1959). CA 53-14279g

172

INCREASE OF CELLULAR CONSTITUENTS IN X-IRRADIATED MAMMALIAN CELLS. G. F. Whitmore, J. E. Till, R. B. L. Gwatkin, L. Siminovitch, and A. F. Graham. (Univ. Toronto, Can.). *Biochim. et Biophys. Acta* **30**, 583-90(1958) (in English). CA-53:6319c.

173

THE INCORPORATION OF RADIOACTIVE PHOSPHORUS IN THE LEUCOCYTE DURING THE EXTRUSION OF PROTEIN INDUCED BY STAPHYLOCOCCAL LEUCOCIDIN. A. M. Woodin and A. A. Wieneke. *Biochem. J.* **87**, 480-7(1963) June.

174

NUCLEIC ACID SYNTHESIS IN DIVIDING CELLS. Philip S. Woods and J. H. Taylor. (Brookhaven Natl. Lab., Upton, N. Y.). *Proc. Intern. Congr. Genetics*, 10th, Montreal, Canada **2**, 320-1(1958). CA-52: 20458f.

## ECOLOGY

175 (TID-12432) PRELIMINARY REPORT ON TRANSLOCATION OF RADIOACTIVE PHOSPHORUS ( $P^{32}$ ) IN A MICHIGAN TROUT STREAM. Progress Report, June 14, 1958-March 11, 1959 on A STUDY OF PRODUCTIVITY IN A STREAM ECOSYSTEM. R. C. Ball (Michigan State Univ., East Lansing) and F. F. Hooper (Michigan Inst. for Fisheries Research, Ann Arbor). Contract AT(11-1)-655. 28p.

On Aug. 5, 1958, an addition of  $P^{32}$  was made to the West Branch of the Sturgeon River in the vicinity of Wolverine, Mich. The objectives of the experiment were to determine how the naturally occurring P of a trout stream is used by plants and animals and to determine by what mechanisms P is transported in a trout stream. The information will be used to understand how P in the form of fertilizers can be used in streams to increase the production of trout. Data are presented on the activity of stream water during passage of the isotope, and the activity of plants, invertebrate animals, and fish collected at various times. Results

## REFERENCES

indicate that the natural P of the stream water is continuously being exchanged with the P in living plants and animals.

- 176 (TID-12433) A SECOND REPORT ON TRANSLOCATION OF RADIOACTIVE PHOSPHORUS ( $P^{32}$ ) IN A MICHIGAN TROUT STREAM. R. C. Ball (Michigan State Univ., East Lansing) and F. F. Hooper (Michigan. Inst. for Fisheries Research, Ann Arbor). 1959. Contract AT(11-1)-655. 33p.

Phosphorus-32 was released in the West Branch of the Sturgeon River, Michigan, on July 8, 1959, at a theoretical maximum concentration of  $1.22 \times 10^{-5}$  mc/ml. Studies were made on the movement of radiophosphorus through the food chain during a two-month period. Data are presented on total water activity at various collecting stations during passage of the isotope, the activity of solids filtered from the water, the activity of plants collected at various stations throughout the experimental period, the activity of bottom-dwelling invertebrates, the activity of insects, and the activity of fish collected at various locations. Results are compared with results from a similar study done in 1958.

- 177 (TID-12309) A THIRD REPORT ON TRANSLOCATION OF RADIOACTIVE PHOSPHORUS ( $P^{32}$ ) IN A MICHIGAN TROUT STREAM. Progress Report. R. C. Ball (Michigan State Univ., East Lansing) and F. F. Hooper (Michigan. Inst. for Fisheries Research, Ann Arbor). 1960. Contract AT(11-1)-655. 20p.

Results are reported from a study on the incorporation of  $P^{32}$  into the food chain in a fresh water stream. Radioactivity in water, plants, insects, invertebrate animals, and fish was measured following the introduction of a concentration of  $1.22 \times 10^{-5}$  mc/ml of  $P^{32}$  into waters of the West Branch of the Sturgeon River, Mich. Results are compared with results from similar studies during 1958 and 1959. An attempt was made to relate uptake to the amount of P present. The influence of chelating agents on the distribution of activity was also studied.

- 178 THE ACCUMULATION OF  $Y^{90}$  FROM AN EQUILIBRIUM MIXTURE OF  $Sr^{90}$ - $Y^{90}$  BY ARTEMIA SALINA (L.). Howard Boroughs, Sidney J. Townsley, and Winifred Ego (Univ. of Hawaii, Honolulu). Limnology and Oceanog. 3, 413-17(1958) Oct.

Artemia salina (L.) was chosen as a representative organism in the second trophic level for studying one phase of the process of transfer of radionuclides through a marine food chain. Adult Artemia were cultured in filtered sea water which contained  $Sr^{90}$ - $Y^{90}$ . They were not fed during the experiment which lasted 92 hours. They were removed at intervals, washed, and their radioactivity determined with an end-window counter. At 16 hours the concentration of radioactivity in the Artemia was about 40 times that of an equal weight of sea water. The radioactivity decayed at a rate which was similar to the decay rate of  $Y^{90}$ . It was estimated that only about 5 per cent of the activity remaining at secular equilibrium was due to  $Sr^{90}$ , the remainder being  $Y^{90}$ . This biological fractionation of  $Sr^{90}$ - $Y^{90}$  may affect the transfer of these hazardous nuclides through food chains leading to human food. The fractionation of these nuclides by laboratory glassware is briefly discussed.

179

- ZINC-65 LEVELS IN OYSTERS IN THE THAMES RIVER (CONNECTICUT). B. W. Fitzgerald, J. S. Rankin and D. M. Skauen. Science 135, 926(1962) Mar.

180

- RADIOISOTOPIC TRACING OF THE MOVEMENT OF AN ESSENTIAL ELEMENT THROUGH AN AQUATIC COMMUNITY WITH SPECIFIC REFERENCE TO RADIOPHOSPHORUS. R. F. Foster (General Electric Co., Richland, Wash.). Publ. staz. zool. Napoli 31, Suppl. 34-69(1959). (In English)

Radioisotopes may be used to trace the metabolism of substances through entire ecosystems and thus provide information available by no other means. The Columbia River below the Hanford reactors provides an unusual opportunity for the study of the uptake of radioisotopes by aquatic organisms since the organisms are chronically exposed to a fresh supply of isotopes introduced more or less continuously with the reactor effluent. The specific activity of the  $P^{32}$  in Columbia River water thus remains approximately constant throughout much of the year. The specific activity of Columbia River organisms is less than that of the water since radioactive decay of the  $P^{32}$  occurs in each trophic level. The decrease in specific activity is in direct proportion to the turnover time for the particular organisms and their position along the food chain. Since most aquatic animals are poikilothermic, their metabolic rates, and thus their turnover rates for phosphorus, change with variations in temperature and so with the season. At low temperatures the turnover time is relatively long, the specific activity is correspondingly low, and the concentration of the isotope in the animal is proportionately low. The reverse is true when temperatures are high. Once the rate constants for biological turnover of appropriate isotopes are established, the observed concentrations of isotopes in animals may be used to estimate feeding rates. Fish that inhabit the Columbia River downstream from the reactors accumulate some of the radioactive materials introduced with the reactor effluent. Although the amounts of isotopes picked up by the fish are too small to cause any detectable radiation damage or to constitute a hazard to persons who eat them, the deposited nuclides can easily be measured. Many of the whitefish (Prosopium sp.) that are taken as samples upriver from the reactors, contain  $P^{32}$ . The presence of this artificial isotope indicates an upstream migration of this species during the spring and late fall. 45 references.

181

- (UW-SA-2688) RELATIONSHIPS BETWEEN THE CONCENTRATION OF RADIONUCLIDES IN COLUMBIA RIVER WATER AND FISH. R. F. Foster and Dan McConnon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). [July 25, 1962]. Contract AT-(45-1)-1350. 24p.

The uptake of radionuclides by fish is a function of a number of interacting factors which results in wide variability. This variability is sufficiently great so that a large number of samples collected over at least one year's time is necessary in order to determine the average concentration in the fish and fluctuations with time, at least in the case of radionuclides with relatively short effective half-lives. Concentration factors derived on theoretical basis which assume a high rate of intake by the fish throughout the year will substantially overestimate the quantities of

## REFERENCES

radionuclides which will accumulate in the fish. This generalization should hold for radionuclides with effective half-lives of several weeks or less in ecological conditions subject to wide variations between seasons.

### 182 A/CONF.15/P/177

**STUDIES ON SOIL-PLANT-ANIMAL INTERRELATIONSHIPS WITH RESPECT TO FISSION PRODUCTS.** Lars Fredriksson, Bengt Eriksson, et al. (Royal Agricultural Coll., Uppsala). 63p.

Studies on the incorporation of fission products in food-chains have extended over several years. Data are reported from studies on plant uptake of strontium-90 and cesium-137 from soils, plant-animal interrelationships with respect to the absorption of strontium-90, and the transport of long-lived fission products in Swedish soils.

### 183

**THE OCCURRENCE, EFFECT AND UTILIZATION OF SPECIFIC ISOTOPES IN THE ENVIRONMENT; REVIEW AND DISCUSSION OF BARIUM.** N. R. French. *UCLA Sch. Med.* 497, 19(1961) Dec.

### 184

**ESTIMATION OF THE LEVELS OF CAESIUM-137 IN SEA-WATER BY THE ANALYSIS OF MARINE ORGANISMS.** R. Fukai and N. Yamagata. *Nature (Lond)* 194, 466(1962) May 5

**185 RADIATION IN ECOLOGY.** Manuel Nieto Garcia (Junta de Energia Nuclear, Madrid). *Energia Nucl. (Madrid)*, 7: No. 26, 27-41(Apr.-June 1963). (In Spanish)

The effects of radiation on an ecological system are reviewed. The radiation sources and the ecological system are first defined. The trophic structure of this system is briefly described, and the ecological pyramid is discussed. The chemical composition of the ecological system and uptake mechanisms are given. The existence of thermal variations and their effects on the ecology are discussed. The response of the ecological system to radioactive contamination is considered. 23 references.

### 186

**ENVIRONMENTAL CONTAMINATION AND GRAZING ANIMALS.** R. J. Garner. *Health Phys.* 9, 597-605(1963) June

### 187

**A SEX DIFFERENCE IN RADIOACTIVITY OF ARTEMIA CULTURED IN SEA WATER CONTAINING PHOSPHORUS-32.** Daniel S. Grosch (North Carolina State Coll., Raleigh) and Mary Ellen Plumb (Marine Biological Lab., Woods Hole, Mass.). *Nature* 183, 122-3(1959) Jan. 10.

Phosphorus-32 was added in known concentration to sea water containing adult brine shrimp, *Artemia salina*. Geiger-Mueller counts were made of individual adults and of samples of the sea water over a significant period of time. Females were found to be more radioactive than males. The possible importance of sex in radioecological studies is discussed.

### 188

(HW-72500(p.139-43)) **RADIOISOTOPES IN STUDYING WATERFOWL DISPERSION.** W. C. Hanson and A. C. Case (General Electric Co. Hanford Atomic Production Operation, Richland, Wash.).

A method to investigate dispersion of waterfowl is described in which heads from birds harvested by hunters are

analyzed for radioisotopes originating from the Hanford reactors. Initial results indicated migration pattern and that 41% of the waterfowl harvested within a fifty-mile radius of the Hanford Reservation during the 1960 to 1961 hunting season were tagged with P<sup>32</sup> from the Columbia River.

**189 (TID-13108) THE USE OF RADIOPHOSPHORUS IN DETERMINING FOOD CHAIN RELATIONSHIPS IN THE AQUATIC ENVIRONMENT.** Final Report. Dale A. Hoffman (Colorado State Univ., Fort Collins) and John R. Olive (American Inst. of Biological Sciences, Washington, D. C.). [1961]. Contract AT(11-1)-398. 46p.

Experiments were conducted to determine the accumulation and concentration of P<sup>32</sup> by a simple food chain consisting of green algae, microcrustaceans *Daphnia*, and Green Sunfish in river water. The accumulations and concentration factors of the organisms were found to be greater at 25 than at 10°C. The results indicate that the algae increased the amount of P for *Daphnia* in the first 24 hr and decreased P after longer periods, and that the amount of P<sup>32</sup> accumulated by *Daphnia* is proportional to the amount of surface area available for P adsorption. Data were obtained on the acquisition of P<sup>32</sup> by the sunfish from various food-chain combinations.

### 190

**THE ACCUMULATION OF RADIOELEMENTS IN CERTAIN GROUPS OF WATER ORGANISMS.** D. I. Il'in, Yu. I. Moskalev, and A. I. Petrova. *Atomnaya Energ.* 5, 171-4(1958). (In Russian)

Studies of radioactive element accumulations in live organisms in a water basin with  $2$  to  $4 \times 10^{-8}$  c/l specific activity indicated selective uptake of P<sup>32</sup>, Sr<sup>89</sup>, Sr<sup>90</sup>, Cs<sup>137</sup>, and Na<sup>24</sup> in plankton, benthon, and fish. The concentration of P<sup>32</sup> is higher by an order of three to four in fish, plankton, and deep-sea organisms than in water, and Sr<sup>89</sup>, Sr<sup>90</sup>, and Cs<sup>137</sup> by an order of two to three. The accumulations of  $\beta$ -active elements found in fish organs were principally in the muscles (44 to 59%) and in the skeleton (16 to 24%). The accumulation of  $\beta$ -active elements in skeleton, gills, fins, and scales is 3 to 5 times higher than in the soft tissues.

### 191

**RADIOISOTOPES IN ECOLOGICAL AND BIOLOGICAL STUDIES OF AGRICULTURAL INSECTS.** D. W. Jenkins (Army Chemical Corps, Fort Detrick, Frederick, Md.). p.1-21 of "Radioisotopes and Radiation in Entomology." Vienna, International Atomic Energy Agency, 1962. (In English)

Research completed or in progress on the use of radioisotopes in biological and ecological studies of insects of agricultural and veterinary importance is summarized, and new avenues of approach for insect-control using radioactive materials are suggested. The many uses of radioisotopes are discussed and the various radioisotopes used are listed. 118 references are given.

### 192

(TID-11355) **ASSIMILATION OF RADIOACTIVE PHOSPHORUS IN HYALELLA AZTECA** (thesis). Robert Frederick Johnson (Iowa State Univ. of Science and Technology, Ames). 1960. 38p. Contract AT(11-1)-59:11.

Results are reported from a study of methods for assaying the role of microcrustaceans in the transfer of solar energy. *Hyalella azteca*, commonly called scuds, were selected for study as representatives of an intermediate link in the food chain from production of organic matter by plants to utilization by fish. Phosphorus-32 was selected

## REFERENCES

as a labeling agent for controlled feeding experiments. Procedures are described. An analysis of variance showed that the  $P^{32}$  uptake by *H. azteca* from bacteria and from concentrations of algae is additive and independent. Factors that affect the feeding and rates of assimilation of phosphorus by *H. azteca* are discussed.

**193** (TID-11816) BIOLOGICAL, CHEMICAL AND RADIOCHEMICAL STUDIES OF MARINE PLANKTON. Reference No. 61-6. Bostwick H. Ketchum (Woods Hole Oceanographic Institution, Mass.). Feb. 15, 1961. Contract AT(30-1)-1918. 16p.

Progress is reported in a study of the biology, chemistry, and radiochemistry of marine plankton populations from 15 collecting stations in the Atlantic Ocean extending from Montauk Point to the vicinity of Bermuda. A list is included of 17 published papers, 6 papers accepted for publication, and 13 reports on work in progress. These publications describe in detail the progress made. A number of species of oceanic plankton algae were isolated. Nitrifying bacteria were obtained from sea water. A significant amount of organic phosphorus was found in sea water at depths greater than 2000 meters. An intensive study was made of the phosphorus metabolism of unicellular algae, using  $P^{32}$  as a tracer. A comparison was made between the uptake of radiophosphorus and radiocarbon by natural phytoplankton populations. A study was continued on the temperature and salinity of the waters over the continental shelf.

**194** HW-60127

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ON THE PASSAGE OF PAIRS OF ELEMENTS THROUGH FOOD CHAINS. H. A. Kornberg. May 1, 1959. 37p. Contract W-31-109-Eng-52. \$1.00(OTS).

The relationship of element pairs passing through food chains is discussed. Emphasis is placed on the calcium-strontium-90 and potassium-cesium-137 pairs. Mechanisms are described by which strontium and calcium are passed along food chains. Experimental facts and theory are combined to question the use of element-pair ratios in evaluating hazards of the radioactive member of the pair.

**195**

PLANKTON AS INDICATOR OF RADIOACTIVE CONTAMINATION OF FRESH WATER RESERVOIRS. G. D. Lebedeva. Med. Radiol. 2, No. 6, 65-9(1957) Nov.-Dec. (In Russian)

Data are given on the intensity of absorption of radioactive strontium by *Daphnia magna*, *Diaptomus amblyodon*, and *Scenedesmus quadricauda*. Experiments concerning the washing out of  $Sr^{90}$  from organism of daphnia are also described.

**196**

CORRELATION OF THE NATURAL RADIOACTIVITY OF THE HUMAN BODY TO THAT OF ITS ENVIRONMENT: UPTAKE AND RETENTION OF RADIUM-226 FROM FOOD AND WATER. H. F. Lucas, Jr. (Argonne National Lab.) Feb. 1961. (ANL-6297) (p.55-66)

**197**

CLAMS AS INDICATORS OF STRONTIUM-90. D. J. Nelson (Oak Ridge National Lab., Tenn.). Science, 137: 38-9(July 6, 1962).

Fresh water clams concentrate strontium-90 in their shells and may be used as indicators of the  $Sr^{90}$  contamination

of their environment. Analysis of data derived from the specific activity of  $Sr^{90}$  in shells showed that  $Sr^{90}$  released to the Tennessee River system remained in solution and that concentrations to a distance of 500 miles from the release site can be predicted on the basis of the dilution of contaminated White Oak Creek water by uncontaminated Clinch-Tennessee River water.

**198** (ORNL-3492(p.95-107)) FOREST STUDIES.

J. S. Olson, G. N. Brown, D. A. Crossley, Jr., et al. (Oak Ridge National Lab., Tenn.).

Computer feedback models have included compartments for woody materials, as a step toward interpreting patterns of forest growth. The positive feedback representing increased photosynthetic rate with increased foliage mass is counteracted by opposing negative feedbacks, representing not only the loss rates from respiration and other processes (litter fall, consumption, translocation) but also a "limiting feedback" related to the capabilities of an area for producing organic matter. Diurnal and seasonal cycles of production were combined in the same model. Further analyses of two- and three-year comparative experiments, in cooperation with the Botany Department of the University of Tennessee, showed different rates of breakdown for several kinds of deciduous leaves measured in the Oak Ridge Reservation and the Great Smoky Mountains. In all environments, leaf species showed large and consistent differences in weight loss of leaves confined in bags of nylon net. Mulberry decayed rapidly to black humus, losing 0.002 to 0.0046 of its total weight per day in different environments. Beech showed the slowest visible signs of decay, with fractional weight losses of only 0.0003 to 0.0012 per day. White oak, Shumard red oak, and sugar maple showed intermediate rates of weight loss and visible destruction. Yearly differences in decay rates emphasize the need for several-year experiments, using closely compared sets of techniques, for drawing generalizations about rates of ecological processes which affect the movement of nutrients or isotopes in contrasting environments. Seasonal measurements of microbial populations of four leaf species in three contrasting forest types during the first year showed a highly significant correlation between leaf weight loss and microbial respiration, especially that of bacteria. Seasonal fluctuations of microbial respiration were primarily correlated with temperature, but other significant correlations were found with bacterial counts, moisture content of the leaves, and age of the litter. The large-scale tracer experiment employing  $Cs^{137}$  in a small stand of yellow poplar is confirming the expectation of rapid circulation of  $Cs^{137}$  through the forest ecosystem. The rapid attainment of maximum foliage concentrations in June was followed by a decrease throughout the growing season. Evidence was found of a marked withdrawal of  $Cs^{137}$  from the leaves back into the trunk prior to leaf fall. Rainwater collections further supported the possibility that in late summer there is a period in which alkali metal reserves are remobilized into the tree. Paper chromatography analyses, autoradiograms, and column elution tests showed that the bulk of  $Cs^{137}$  activity is in the phloem tissue (parenchyma), where it exists only in the ionic form, and that only ionic bonding takes place between the cesium and the wood. In addition to  $Cs^{137}$  income from rainfall and litter fall, downward movement of  $Cs^{137}$  in roots of tulip poplar apparently provides an important contribution of this nuclide into the soil (Emory silt loam) of the tagged forest. Early litter sampling on lines on a close spacing (2 cm) showed very abrupt variation, due partly to uneven movement of rainout

## REFERENCES

over the incomplete litter cover of the mull humus. The extent of variation within centimeter distances was greater than two orders of magnitude. Early sampling indicated the importance of root contribution to the highly variable initial distribution. Root fragments which could be separated from inorganic soil particles contributed at least 90% of the total activity as of July 16, 1962. Fine rootlets that could not be separated from sieved mineral soil may already have contributed to radioactivity in this and subsequent samples. Wide differences in concentrations of  $Cs^{137}$  were found in mushrooms growing on the tagged forest floor. This variability was not only the result of large differences among substrates but also the result of differences within one substrate at different locations. Concentrations of  $Cs^{137}$  in litter were from 0.1 to 68 times lower than the concentrations in the underlying soil and roots. Variations in concentrations of  $Cs^{137}$  in mineral soil exceeded two orders of magnitude for surface samples taken only 10 cm apart. Two types of food chains are being compared in the tagged forest: the green foliage-herbivorous arthropod-predaceous arthropod type of food chain and the leaf litter-herbivorous arthropod-predaceous arthropod type.  $Cs^{137}$  concentrations were lower in the leaf litter-soil arthropod food chain than in the green foliage food chain, since leaching of cesium from green leaves was the radioisotope source for the litter layers. Radioisotope concentration in leaf litter increased gradually during the summer and abruptly during the early autumn as leaf fall progressed. During the summer months herbivores had  $Cs^{137}$  concentrations almost as high as the concentration in leaf litter. Herbivore radioactivity increased in the autumn but not as rapidly as did leaf litter radioactivity. Predators also showed an increase in  $Cs^{137}$  content during the summer and early autumn. During July and August the herbivore and predator parts of the leaf litter-soil arthropod food chain had an added input due to direct feeding on the green foliage. Phalangids (*Lio-bunum* sp.), for example, had  $Cs^{137}$  contents which were a factor of 2 or more higher than leaf litter concentrations. Also, some of the predators were evidently feeding in the green foliage food chain although they were trapped on the forest floor. The result was that the animal portions of the leaf litter food chain appeared abnormally high during July and August. In October the green foliage had disappeared, and the leaf litter food chain assumed a  $Cs^{137}$  distribution resembling that of the green foliage food chain.

199 A/CONF.15/P/392

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ABSORPTION OF CESIUM-137 BY COMPONENTS OF AN AQUATIC COMMUNITY. Robert C. Pendleton and Wayne C. Hanson. 10p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

Results are reported from studies on the uptake of radioactive cesium made by radiochemical analyses of field collections from an impoundment contaminated by fission products from a separations plant, and controlled experiments with cesium-137. Although uptake of this element from soils by terrestrial plants is low, concentration factors of more than 5000 are demonstrated for aquatic organisms. Sorption by the biota coupled with adsorption on inorganic surfaces removed 95% of the original contamination within two days, and 99% within six days. Absorption rates varied according to habitual and trophic levels. Algae and other submerged plants became radioactive very rapidly, and

animals feeding on these plants also had a high rate of uptake, since they were getting cesium from three routes, i.e., that absorbed by the plant, that absorbed on the plant surfaces, and from direct sorption. Carnivorous forms accumulated the element at a slower rate, and emergent plants had the least rapid build up. The rate of uptake was not related to ultimate contamination levels in many forms. The effect of trophic levels upon the degree of contamination is discussed, and the routes through which cesium-137 may be transferred from the aquatic environment to terrestrial forms are delineated. Comparative levels of contamination reached by twenty-seven representative aquatic species under experimental and field conditions are reported. The maximum deposition site for  $Cs^{137}$  was in the gonads of fish, muscle of frogs and waterfowl, and roots and plants. The results of these studies indicate that cesium-137 is more mobile under aquatic conditions than in soils. Also, the availability of cesium-137 at levels approaching its accepted MPC in drinking water results in unsafe contamination of fish, frogs, waterfowl, and forage that might be consumed by domestic animals.

200 HW-59500(p.42-6)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECTS OF SOME ENVIRONMENTAL FACTORS ON BIOACCUMULATION OF CESIUM-137 IN AN AQUATIC COMMUNITY. R. C. Pendleton. 5p.

Algae, submerged seed plants, grass, fish, and amphibians changed  $Cs^{137}$  contamination levels in response to temperature variations. Shading reduced uptake by submerged plants, and emergent plants rooted in gravel accumulated more  $Cs^{137}$  than those rooted in mud. Contamination levels in all organisms decreased because of loss to bottom mud and dilution by increased biomass. Highest contamination generally occurred in the highest trophic levels.

201 (TID-15963) RATES AND PATTERN OF MOVEMENT OF RUBIDIUM<sup>86</sup> AND PHOSPHORUS<sup>32</sup> IN A CENTRAL MESOPHYTIC FOREST, PARKE COUNTY, INDIANA. Annual Progress Report. Robert Petty (Wabash Coll., Crawfordsville, Ind.). Feb. 25, 1962. Contract AT(11-1)-1006. 54p.

Terrestrial mineral cycling in a central mesophytic forest was studied at the Allee Memorial Woods in West Central Indiana. The Allee Woods has been under continual ecological study for the past 4 years, resulting in a detailed description of the virgin beech-maple forest, midseral oak stand, and an abandoned field used as the reference ecosystems. Selected trees were inoculated with  $Ru^{86}$  or  $P^{32}$  and the rate of migration from leaves to soil was determined. Data were compared with detailed microclimatic data for the same period as well as microorganism and arthropod population levels.

202

FIXATION AND ELIMINATION OF PHOSPHORUS-32 BY SOME ORGANISMS OF THE BLACK SEA. A. E. Pora, J. Oros, D. Rusdea, F. Stoicovici, and C. Wittenberger. *J. Physiol. (Par)* 53, 449-50(1961) Mar-Apr.

203

CONCENTRATION OF RADIOACTIVE ISOTOPES OF PHOSPHORUS AND STRONTIUM IN FRESH WATER MOLLUSKS. Z. S. Povelyagina and M. M.

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Telitchenko. *Byull. Moskov. Obshchestva Ispytatelei Prirody, Otdel. Biol.* 64, No. 2, 79-83(1959). CA 53-22543d

**204** (NP-11678) RADIOISOTOPIC BIOCHEMICAL PROBE FOR EXTRATERRESTRIAL LIFE. Annual Progress Report to National Aeronautics and Space Administration. (Resources Research, Inc., Washington, D. C.). Feb. 15, 1962. Contract NASr-10. 92p.

The feasibility of a radioisotopic biochemical experiment for extraterrestrial life detection has been established. A medium has been developed which supports the evolution of detectable levels of radioactive carbon dioxide by representative bacteria, streptomycetes, fungi, and algae within a period ranging from minutes to several hours. The group of test organisms which respond includes aerobes, anaerobes, facultative anaerobes, thermophiles, mesophiles, heterotrophs, phototrophs, spore formers, and non-spore formers. Mixed populations in soils have been tested with excellent response. A number of radioactive substrates have been tested singly and in combinations. The most satisfactory response has been achieved through the combined use of sodium formate- $C^{14}$  and uniformly labeled glucose- $C^{14}$ . Two generations of the instrumentation for the experiment have been fabricated and modifications made to the second model. At the present time the instrument, programmer, and associated electronics weigh approximately one and one-quarter pounds. The soil sample is obtained by ejection of two fifty foot lengths of adhesive impregnated string. The string, with collected soil particles, is reeled back into the culture chamber. Here the radioactive medium is applied, and a solid state radiation detector monitors metabolically evolved labeled gases. The instrument has been successfully field tested.

**205** MOVEMENT OF RADIOACTIVE SUBSTANCES IN FOOD CHAINS. R. Scott Russell (Agricultural Research Council Radiobiological Lab., Letcombe Regis, Berks, Eng.). p.164-72 of "Atomic Energy Waste. Its Nature, Use and Disposal." E. Glueckauf, ed. New York, Interscience Publishers Inc., 1961.

When fission products are deposited on the surface of the earth or on water they can be hazardous to man or to animals as sources of external radiation or by their accumulation within the organism itself. The passage of radioactive substances through food chains and factors affecting  $Sr^{90}/Ca$  relationships in the total diet are discussed. Procedures are described for mitigating the hazards due to the contamination of agricultural lands by fall-out fission products.

**206** THE PASSAGE OF  $Sr^{90}$  THROUGH FOOD CHAINS. R. S. Russell. p.140-59 of "Radiostrontium." Strahlenschutz No. 18. Munich, Gersbach & Sohn Verlag, 1961.

An over-all appraisal of the rate at which fission products may enter into food chains under natural conditions is presented under two sets of circumstances, continuous deposition as in world-wide fall-out and a sudden deposition of short duration as would occur from a reactor accident or close to ground zero after an atomic weapon explosion. The mechanism of direct contamination of plants is discussed.

**207** ACCUMULATION OF CHEMICAL ELEMENTS BY FRESH WATER ORGANISMS FROM WATER SOLUTIONS. I. CONCENTRATION OF RADIOACTIVE ISOTOPES OF

PHOSPHORUS, ZINC, STRONTIUM, RUTHENIUM, CESIUM, AND CERIUM BY VARIOUS SPECIES OF FRESH WATER MOLLUSCA. E. A. Timofeeva-Resovskaya, E. I. Popova, and G. G. Polikarpov. *Byull. Moskov. Obshchestva Ispytatelei Prirody, Otdel. Biol.* 63, No. 3, 65-78(1958). CA-53: 590h.

**208** ACCUMULATION OF CHEMICAL ELEMENTS FROM WATER SOLUTIONS BY FRESH-WATER ORGANISMS. II. COEFFICIENT OF ACCUMULATION OF DIFFERENT RADIOISOTOPES BY LIMNAEA STAGNALIS. E. A. Timofeeva-Resovskaya and N. V. Timofeev-Resovskii. *Byull. Moskov. Obshchestva Ispytatelei Prirody, Otdel. Biol.* 63, No. 5, 123-31(1958). CA-53:7444g.

**209** SPECIFIC ACCUMULATORS OF INDIVIDUAL RADIOISOTOPES AMONG FRESH WATER ORGANISMS. E. A. Timofeeva-Resovskaya, N. V. Timofeev-Resovskii, and E. A. Gileva (Lab. of Biophysics, Ural Branch of the Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.*, 140: 1437-40(Oct. 21, 1961). (In Russian)

The distribution coefficients of 19 different radioisotopes have been determined for 32 kinds of fresh water plants and for 20 kinds of fresh water, animal life. Low accumulation coefficients are found on the average for  $S^{35}$ ,  $Ca^{45}$ ,  $Ge^{71}$ ,  $Sr^{90}$ ,  $I^{131}$  and  $Cs^{137}$ . High coefficients are found on the average for  $P^{32}$ ,  $Fe^{59}$ ,  $Co^{60}$ ,  $Zn^{65}$ ,  $Ce^{144}$ ,  $Hg^{203}$ ,  $Y^{91}$ ,  $Zr^{95}$  and  $Nb^{95}$ . Average coefficients are found for  $Cr^{51}$ ,  $Rb^{86}$ ,  $Ru^{106}$  and  $Cd^{115}$ . The accumulation coefficients are higher on the average for plant life than for animal life. Specific forms of animal life are noted that show high accumulation coefficients for  $P^{32}$ ,  $Co^{60}$ ,  $Sr^{90}$ ,  $Y^{91}$  and  $Cs^{137}$ . Single-cell forms of plant life and filamentary seaweed accumulate 6 to 8 different radioisotopes. Seven of fifteen of the radioisotopes are strongly concentrated by 5 kinds of animal life (out of 20 different kinds investigated), and 13 of 19 radioisotopes are strongly concentrated by 10 kinds of plant life (out of 32 kinds investigated). These results show the importance of plant life (especially, filamentary seaweed) in purifying water.

**210** HW-48523(Del.)  
General Electric Co. Hanford Atomic Products  
Operation, Richland, Wash.

CONCENTRATION OF RADIOISOTOPES IN COLUMBIA RIVER WHITEFISH IN THE VICINITY OF THE HANFORD ATOMIC PRODUCTS OPERATION. D. G. Watson and J. J. Davis. Feb. 18, 1957. Decl. with deletions Oct. 27, 1958. 133p. Contract W-31-109-Eng-52.

Results of a study on the uptake of radioisotopes by Columbia River whitefish for the period from June 1950 to December 1956 are presented. Differences in concentrations of radioactive materials as related to geographical location, season, age, specific tissue, and concentration of reactor effluent in the river are discussed. Changes in concentration with cooking were determined. Maximum concentrations of  $P^{32}$  on the order of  $2 \times 10^{-4}$   $\mu\text{g/g}$  of flesh were recorded for sportfishing areas immediately upstream and downstream from the Hanford Atomic Products Reservation. Human consumption of whitefish flesh at the rate of 2.7 pounds per week from public fishing areas during the fall months would produce maximum permissible concentrations of  $P^{32}$ .

**211** ZINC-65 IN MARINE ORGANISMS ALONG THE OREGON AND WASHINGTON COASTS. D. G. Watson, J. J.

## REFERENCES

Davis, and W. C. Hanson (General Electric Co., Richland, Wash.). *Science*, 133: 1826-8 (June 9, 1961).

The concentration of zinc-65 in marine animals and plants near the mouth of the Columbia River is presented. Amounts of radiozinc found in the biota diminished rapidly with the distance from the river mouth. The highest levels were found in plankton, algae, and mollusks. Of the human foods, oysters exhibited the highest levels.

**212** (HW-65500(p.183-7)) ZINC-65 IN MARINE MOLLUSKS NEAR THE MOUTH OF THE COLUMBIA RIVER. D. G. Watson, J. J. Davis, and W. C. Hanson. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

Levels of Zn<sup>65</sup> in mollusks from the Columbia River in 1957 and 1959 are presented together with possible factors responsible for interspecies and seasonal changes in concentration.

**213** DIRECT AND FOOD-CHAIN UPTAKE OF CESIUM<sup>137</sup> AND STRONTIUM<sup>85</sup> IN BLUEGILL FINGERLINGS. Louis G. Williams and Quentin Pickering. *Ecology*, 42: 205-6 (Jan. 1961).

Bluegill fingerling fish, accumulating Cs<sup>137</sup> and Sr<sup>85</sup>, by way of the *Euglena*-*Daphnia* food chain, show higher concentration and retention of these nuclides after 48 hours than by direct uptake from water. Apparently some of these radionuclides, which have been taken up by *Euglena*, are bound to a chemical mechanism. This bound condition enables them to pass along a food chain through *Daphnia* into bluegills. Thus, higher concentrations and retentions of these radionuclides were obtained from the food chain route than from solutions in which the organisms were submerged. (Public Health Eng. abstr., 61: No. 6, 1961)

**214** ENVIRONMENTAL CONTAMINATION WITH IODINE-131 IN JAPAN. N. Yamagata and K. Iwashima. *Nature (Lond)* 193, 892 (1962) Mar.

**215** ENVIRONMENTAL CONTAMINATION WITH SHORT-LIVED RADIONUCLIDES IN JAPAN IN 1961. N. Yamagata and K. Iwashima. *J. Radiat. Res. (Tokyo)* 3, 48-62 (1962) Mar.

## ENTOMOLOGY

**216** INHIBITED OVIPOSITION BY FEMALES OF *GRYLLUS ASSIMILIS* (F.), INDUCED BY RADIOACTIVE MALES, USING L-METHIONINE-METHYL-<sup>14</sup>C. A. A. Abdel-Malek and D. K. McE. Kevan (McGill Univ., [Montreal]). *Nature*, 192: 681-2 (Nov. 18, 1961).

Results of matings between radioactive and normal or non-radioactive individuals of *Gryllus assimilis* (North American field crickets) are reported. The treatment of males with L-methionine-methyl-carbon-14 caused inhibition of egg-laying females and sterility of the male itself. This inhibited oviposition applies to both radioactive and normal virgin females when they are mated with radioactive males. However, if the female is mated with a normal male no effect is noticed in normal oviposition whether the female is normal or radioactive. As a matter of fact, it appears that the radioactive female lays more eggs when mated with a normal male.

**217** (AEC-tr-5142) USE OF RADIOISOTOPES AND RADIATION IN THE FIELD OF PLANT PROTECTION.

S. V. Andreev, B. K. Martens, and V. A. Molchanova. Translated from p.23-37 of "Proceedings of the Symposium on Radioisotopes and Radiation in Entomology, held in Bombay, December 5-9, 1960." (a publication of the International Atomic Energy Agency, Vienna, 1962. (STI/PUB/38(p.23-37)). 19p.

Extensive investigations are being carried out in the Soviet Union on applications of radioisotopes and ionizing radiation in the control and elimination of insects and microorganisms that attack plants of agricultural interest. Isotopes have been used as tracers to follow the movements of pests and parasites, to define reservoir areas, to determine population size, food cycles, and to establish predatoriness and parasitism among insects, to follow the movement of insecticides within plants and within plant pests, to make a comparative evaluation of toxic agents having a systemic action, and to ascertain the duration of the toxic characteristics of such agents in plants and agricultural produce. The effects of ionizing radiation on microorganisms, seeds, and insects were studied and a gamma irradiation facility was designed for the control of insect pests in stored grains and other seeds.

**218** RADIOACTIVE INSECTS? W. Arthur. *Ala. Ag. Exp. Highlights of Ag. Res.* 5, 4 (1959)

**219** NOTE ON DISPERSAL OF RADIO-ACTIVE GRASSHOPPERS. W. F. Baldwin and others. *Can. Entom.* 90, 374-6 (1958) June

**220** RADIOTRACER LABELING OF A NATURAL TEPHRTID POPULATION AND FLIGHT RANGE OF THE WALNUT HUSK FLY. M. M. Barnes. *Ann. Entom. Soc. Am.* 52, 90-2 (1959) January

**221** THE SULFUR METABOLISM OF INSECTS. III. THE METABOLISM OF CYSTINE, METHIONINE, TAURINE, AND SULFATE BY THE HOUSEFLY, *MUSCA DOMESTICA*. Val F. Cotty, S. Mark Henry, and John D. Hilchey. *Contribs. Boyce Thompson Inst.* 19, 379-92 (1958). CA-53:2491e.

**222** LABELLING OF BEES BY MEANS OF RADIOACTIVE GOLD. G. Courtois and J. Lecomte. *Int. J. Appl. Radiat.* 5, 265-8 (1959) July

**223** COMPARATIVE ELIMINATION OF RADIOCESIUM AND RADIOSTRONTIUM BY GRASSHOPPERS. D. A. Crossley, Jr. and Jay H. Schnell (Oak Ridge National Lab., Tenn.). *Ann. Entomol. Soc. Am.*, 54: No. 2, 459-61 (Mar. 1961).

A difference was found in the relative accumulation of Sr<sup>90</sup> and Cs<sup>137</sup> by insects at the White Oak Lake bed, a contaminated radioactive area at the Oak Ridge National Laboratory, Oak Ridge, Tenn. Insects reached Cs<sup>137</sup> concentrations which were almost as high as concentrations in the plants, but Sr<sup>90</sup> concentrations in the insects were nearly an order of magnitude lower than the corresponding plant concentrations. This difference was explained by results from laboratory studies with Sr<sup>85</sup> and Cs<sup>137</sup> in grasshoppers, which showed that Sr<sup>85</sup> was eliminated much more rapidly than Cs<sup>137</sup>.

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- 224** INSECT-VEGETATION RELATIONSHIPS IN AN AREA CONTAMINATED BY RADIOACTIVE WASTES. D. A. Crossley, Jr., and Henry F. Howden (Oak Ridge National Lab., Tenn. and Entomology Research Inst., Ottawa). *Ecology*, 42: No. 2, 302-17 (Apr. 1961).
- The development of insect populations on vegetation growing on White Oak Lake bed was followed for 3 years (1956 to 1958), immediately following the draining at White Oak Lake. This lake had served as a final holding basin for Oak Ridge National Laboratory's low-level wastes, and the alluvial terrain exposed upon drainage contained significant concentrations of radioisotopes, including  $\text{Sr}^{90}$  and  $\text{Cs}^{137}$ . The insect biomass, estimated by sweep-net and box-trap methods, was about 200 to 300 mg/m<sup>2</sup>. No change could be demonstrated during the seasons, and evidently little change occurred between years. Significant concentrations of both  $\text{Sr}^{90}$  and  $\text{Cs}^{137}$  were found in samples of herbivorous insects. Concentrations of  $\text{Sr}^{90}$  were about 25% of the soil values, and  $\text{Cs}^{137}$  concentrations were about 1% of the soil values. However, the biomass of insects was minute compared to plant and soil masses, and the herbivorous insects contained but a minute fraction of the fission products in the system, since the bulk of these radioisotopes is in the soil. A sizeable fraction of the materials taken up by plants, however, may pass through the herbivorous insects in the system. Insect populations were followed in 2 areas each of smartweed, sedge-rush, and willow vegetation. Each of the vegetation types acquired its own characteristic insects. First-year insect populations tended to be dominated by one or a few species represented by many individuals. The second-year populations showed a reduction in numbers for the dominant species and an influx of additional species, accompanying an increase in plant diversity. No such reduction of the dominant species occurred in the willow areas, presumably because the willows were increasing their coverage each year, and additional species of plants were not invading the willow stands.
- 225** THE UPTAKE AND ELIMINATION OF CESIUM-137 BY A GRASSHOPPER—*ROMALEA MICROPTERA*. D. A. Crossley, Jr. (Oak Ridge National Lab., Tenn.) and M. E. Pryor. *Health Phys.* 4, 16-20 (1960) Oct.
- Adults of *Romalea microptera*, the eastern lubber grasshopper, were fed cesium-137 in bean plants to investigate uptake and elimination of this isotope. A biological half-life of 4 to 5 days was obtained. In experiments where grasshoppers were allowed to feed repeatedly on cesium-contaminated food, the biological half-life was used to predict the equilibrium values. Most of the ingested  $\text{Cs}^{137}$  was concentrated in muscular tissue, but some was also found in the digestive tract and reproductive organs. Only trace amounts were found in the exoskeleton.
- 226** MIDGE LARVAE AS INDICATORS OF RADIOACTIVE POLLUTION. La Verne L. Curry (Central Michigan Coll., Mount Pleasant, Mich.). *Purdue Univ., Eng. Bull., Ext. Ser.*, No. 106, 269-80 (Mar. 1961).
- The role of midge larvae, or blood worms, as an indicator or radioactive pollution of surface waters was investigated. The larvae of two species were obtained from a silt deposit and studies were made on larvae ecology and feeding habits and their position in specific food chains. The uptake of  $\text{Fe}^{59}$  and  $\text{P}^{32}$  by the larvae was measured. The results of these studies indicate that much has to be learned of the ion exchange between water-hydrosol systems and hydrosol-larvae systems. Both experiments using  $\text{P}^{32}$  and  $\text{Fe}^{59}$  indicate that the exchange of the radionuclides at the mud-water interphase occurs within 6 hr and that there is considerable penetration by the radionuclides. It was concluded that the larvae of *T. plumosus* and *T. decorus* cannot be used as indicators of water pollution due to  $\text{P}^{32}$  and  $\text{Fe}^{59}$  because of the low rate of uptake by the larvae as compared to the resulting activity of the hydrosol from the water.
- 227** DISPERSAL OF ADULT HIPPELATES PUSIO, THE EYE GNAT. R. P. Dow. *Ann. Entom. Soc. Am.* 52, 372-81 (1959) July
- 228** (HW-69500(p.31-4)) EFFECTS OF  $\text{Sr}^{89}$  UPON POPULATIONS OF MEAL MOTHS. H. E. Erdman (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).
- Populations of *Ephestia*, the Mediterranean flour moth, were cultured on cornmeal spiked with different concentrations of  $\text{Sr}^{89}$ . Several fitness components were measured to illustrate how insect populations react when irradiation is a chronic environmental factor. All levels of  $\text{Sr}^{89}$  employed in this experiment were detrimental to the developing organisms; those which attained adulthood reproduced another generation even though reduced in numbers.
- 229** STUDIES ON THE INFLUENCE OF RADIOACTIVE-RAYS UPON THE HEMOCYTES OF THE SILKWORM, BOMBYX MORI, L. IV. ON THE SEXUAL DIFFERENCES BETWEEN THE EFFECTS OF THE INGESTED RADIOISOTOPES ON THE NUMBER OF HEMOCYTES OF THE SILKWORM. Toshioki Gamo, Hisao Nishiyama, and Shigeo Midorikawa (Shinshu Univ., Japan). *Radioisotopes (Tokyo)*, 9: 17-24 (Apr. 1960). (In Japanese)
- Attempts were made to show some sexual differences in the destructive influences of radiation upon the numbers of hemocytes of the silkworm. Just moulted silkworm larva of the fifth stage were administered 0.1 cc of 0.5% solution  $\text{Ca}^{45}\text{Cl}$  or 0.3% solution of  $\text{H}_3\text{P}^{32}\text{O}_4$  through the mouth. It was concluded from the results that the largest damage of  $\text{Ca}^{45}$  and  $\text{P}^{32}$  was inflicted on the proleucocyte, especially in the male silkworm.
- 230** THE ACCUMULATION AND ELIMINATION OF  $\text{Sr}^{90}$  AND  $\text{Cs}^{137}$  BY THE CADDIS FLY HALESUS INTERPUNCTATUS ZETT. A. B. Getsova and G. A. Volkova (Inst. of Zoology, Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.*, 139: 483-4 (July 11, 1961). (In Russian)
- Larvae of the caddis fly were placed in 5 liters of water which had been contaminated with about 1000 counts/minute of  $\text{Sr}^{90}$  or  $\text{Cs}^{137}$ . After 3 and 6 hours, 1, 4, and 8 days, a definite number of the insects were removed from the aquarium. Part of the insects were dried, weighed and counted in order to obtain the amount of  $\text{Sr}^{90}$  and  $\text{Cs}^{137}$  accumulated by the organism. The remainder of the insects were placed in clean water for 1, 4, and 14 days in order to determine the rate of decontamination. Activity determinations were made on both the cocoon and on the larva. The greatest amount of residual activity is left in both the cocoon and in the larva after an 8-day accumulation of activity as compared to a 3 or 6 hour accumulation of activity. Most of the desorption of activity from the cocoon takes place during the first day. The contamination in the larva is removed more slowly and uniformly.



## REFERENCES

- 231** ACCUMULATION AND REMOVAL OF RUTHENIUM-106, CERIUM-144 AND PROMETHIUM-147 BY THE FLY *HALESUS INTERPUNCTATUS* ZETT. A. B. Getsova and G. A. Volkova (Zoological Inst., Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.*, 144: 1163-4(1962). (In Russian)
- Continuing previously published studies (*Doklady Akad. Nauk S.S.S.R.*, 133: (1960) No. 2; *ibid.*, 139: (1961) No. 2.) on the desorption of radioactive materials from water insects, the removal of fission fragments from the fly *Halesus interpunctatus* Zett was investigated by means of the method described in the above-cited papers, taking into account the self-absorption of  $Pm^{147}$ . It was found that the residual activity of the insect depended on the length of their stay in the radioactive environment. From larvae, Pm was removed to the greater extent (residual activity 18%), followed by Ce (29%) and Ru (47%); from adult insects about half of the accumulated activity can be removed. Comparison with previous data on Sr and Cs indicated that there is a direct correlation between the period of accumulation and the removal of the radioisotope; Sr and Cs are removed to a greater extent from the adult specimens, Ru, Ce and Pm from the larvae. This is probably due to the ion-exchange type adsorption mechanism of Sr and Cs which can be washed off more easily from the surface of the adult insects.
- 232** BIOLOGICAL RESPONSE TO MIXED RADIATIONS. Daniel S. Grosch, Robert L. Sullivan, and Leo E. LaChance (Marine Biological Lab., Woods Hole, Mass. and North Carolina State Coll., Raleigh). *Nucleonics* 15, No. 12, 64, 66(1957) Dec.
- In reactor and certain accelerator situations radiation is often present as a mixture of radiations. To study the additive effects of such mixtures, a series of experiments was made on the combined sterilizing effects of external x rays and ingested  $\beta$  emitters ( $P^{32}$  and  $Sr^{89}$ ) on the ectoparasitic wasp, *Habrobracon juglandis*. (L.T.W.)
- 233** DISTRIBUTION OF ZINC-65 IN THE WASP, HABROBRACON, AND ITS EFFECTS ON REPRODUCTION. Daniel S. Grosch (North Carolina State Coll., Raleigh). *Nature*, 195: 356-8(July 28, 1962).
- Adults of the habrobracon wasp were fed with  $Zn^{65}$  sulfate or exposed externally to  $Zn^{65}$  chloride. The radioactivity of whole wasps, body parts, and eggs were measured along with the hatchability of the eggs. Eggs were most radioactive on the third day and egg production was consistently lower than for control wasps. Nearly all the radioactivity in the wasp was abdominal; during the first two days, most of the ingested  $Zn^{65}$  was associated with the digestive tract. In the male, the reproductive system did not become appreciably radioactive. Since less than 20% of the  $Zn^{65}$  meal is eliminated via the eggs, it is concluded that the effects of  $Zn^{65}$  are due to zinc toxicity.
- 234** (ORO-378) THE GENETIC AND DEVELOPMENTAL EFFECTS OF INGESTED RADIOACTIVES IN HABROBRACON. Final Report. D. S. Grosch (North Carolina State Coll., Raleigh). [1960?]. Contract AT(40-1)-1314. 10p.
- Data are summarized from a study on the genetic effects of ingested radioisotopes in the wasp *Habrobracon*. Results demonstrated the ovaries to be the weakest link in the insect life cycle following ingestion of  $P^{32}$  by adult females.
- Damage to the gonads was revealed by direct observation of whole mounts of ovarioles and by deenerated egg production and lowered hatchability. The life span was also shortened by ingestion of radioisotopes.  $S^{35}$ ,  $Ca^{45}$ , and  $Sr^{89}$  were also fed. Temporary and permanent infecundity and sterility were induced by  $Sr^{89}$ , but it was not as effective as  $P^{32}$ . The influence of the other two isotopes was seen only in reduced differentiation and hatchability of the most sensitive cell types. A descending order of effectiveness of the isotopes was shown to correspond to the ascending order of their physical half lives. Relatively brief biological half lives complicated the comparison of alkaline earth elements with other isotopes. A list is included of publications resulting from these studies.
- 235** ABSORPTION, METABOLISM, AND EXCRETION OF CARBON-14-LABELED ALLETHRIN BY HOUSE FLIES. Theodore L. Hopkins and Wm. E. Robbins. *J. Econ. Entomol.* 50, 684-7(1957). CA-52: 6704a.
- 236** A/CONF.15/P/1291  
L'ABSORPTION INTESTINALE DE  $P^{32}O_4H_2Na$  CHEZ *RUTILUS RUTILUS* L. EN FONCTION DE LA QUANTITÉ DE PHOSPHATE DU SANG. (The Intestinal Absorption of  $P^{32}HNa_2$  in *Rutilus Rutilus* L., as a Function of the Total Phosphatemia.) Alexandre A. Kudriavtzev (Veterinary Research Inst., Moscow) and A. Eugène Pora (Univ. of Cluj). 9p.
- The intestinal absorption of phosphates in higher animals is inhibited by an increase in the total phosphatemia. This was investigated on roach (*Rutilus rutilus* L.) caught in the lakes around Moscow during November and December of 1957. It was shown that the phosphates dissolved in the external medium reach the bloodstream of the fish through its branchiae. They accumulate in the organs only in very small quantities and are excreted almost entirely by the kidneys. The phosphates contained in the food are absorbed by the intestines. They accumulate in the liver, encephalon, and muscles. If the amount absorbed is large as compared to that which is so accumulated, the phosphates also are excreted by the kidneys. When a large amount of phosphates is supplied in the food, in addition to those absorbed from the external medium through the branchiae, the absorption and accumulation of the former will be reduced. If the accumulation of phosphates following branchial absorption be rated as 1, the deposition following intestinal absorption would be rated at about 50 and that noted for simultaneous branchial and intestinal absorption would be about 10. Thus it is that an increase in the phosphatemia inhibits the absorption and accumulation in the body organs of the phosphates present in the food. Even if it is absorbed, this phosphate is excreted by the kidneys in large amounts, showing that it can be transformed into an organic form which is systemically useful.
- 237** THE USE OF GAMMA RADIATION FROM COBALT-60 IN THE CONTROL OF DISEASES OF THE HONEYBEE AND THE STERILIZATION OF HONEY. H. Katznelson and J. A. Robb. *Canad. J. Microbiol.* 8, 175-9(1962) Apr.
- 238** JPRS-2453  
A METHOD OF TAGGING INSECTS BY GIVING THEM RADIOACTIVE ISOTOPES WITH FOOD. G. D. Khudadov.

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Translated from *Byull. Moskov. Obshchestva Ispytateley Prirody, Otdel Biol.* 64, No. 3, 35-45(1959). 21p. OTS.

A study was made to determine the best method of labeling insects using radioactive food. Flies and roaches were used in the study which compared  $P^{32}$ ,  $Ca^{45}$ ,  $Fe^{59}$ ,  $Zn^{65}$ ,  $Si^{31}$ ,  $Y^{81}$ ,  $Cd^{115}$ ,  $I^{131}$ ,  $Ba^{140}$ , and  $La$  in various food preparations. It was found that a 24-hr exposure was required for 100% tagging, the best results being obtained with  $P^{32}$  in a mixture of 3 parts milk and 1 part 10% sugar water. A direct relation was found between  $P^{32}$  concentration in food and the radioactivity of the flies, and the females were twice as radioactive as males, being twice as heavy. The effects of elimination, isotope decay, and energy of the emitted ray were considered. Radioisotopes with a beta above 0.8 Mev and a half life not less than 1 week are suitable. The food for studies running 10 to 20 days should contain 1 to 3 microcuries.

### 239 TID-7554(p.527-35)

Department of Agriculture. Beltsville, Md. STUDIES OF INSECTS AND INSECTICIDES WITH RADIOACTIVE MATERIALS. A. W. Lindquist. p.527-35 [of] PROCEEDINGS OF THE INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BROOKHAVEN NATIONAL LABORATORY, MAY 13-17, 1957. 9p.

Entomology is among the scientific disciplines employing radioactive materials in studies on the biology, physiology, toxicology, biosynthesis, disease transmission, and effects of radiation on reproduction, habits, longevity, and control of insects. Flight habits, dispersal distances, migrations, longevity, and population numbers have been studied with specimens tagged with radioactive materials. Results are reviewed from studies on the effects of radiation on insects and studies with radioactive insecticides. Applications in the control of insect pests are discussed.

### 240

USE OF RADIOACTIVE CARBON FOR LABELING FLEAS. N. S. Novokreshchenova, I. S. Soldatkin, L. K. Denisenko, and L. A. Martens. *Med. Parazit. (Mosk)* 30, 72-6 (1961) Jan.-Feb.

241 STUDIES WITH RADIOACTIVE YTTRIUM IN FLIES. I. RETENTION AND DISTRIBUTION IN *DROSOPHILA* AFTER INJECTION. Per Oftedal (Norwegian Radium Hospital, Montebello, Norway). *Intern. J. Radiation Biol.*, 3: 211-21(Mar. 1961). (In English)

After injection into *Drosophila melanogaster* males,  $Y^{91}$  citrate is completely retained. The pattern of distribution is shown to depend upon the injection site, and upon the age of the fly at the time of injection. Microscopically, it is shown that two alternative patterns of distribution occur. The radioactivity is concentrated either in the pericardial cells and the thoracic nephrocytes, or in the hemocytes. The mechanism deciding which of these patterns will obtain is discussed. It is presumed that it depends upon the type of aggregate formed when the  $Y^{91}$  citrate is prepared from the solution of  $Y^{91}Cl_3$ . The findings are discussed, but no definitive explanation can be given.

242 STUDIES WITH RADIOACTIVE YTTRIUM IN FLIES. II. RETENTION AND DISTRIBUTION IN *DROSOPHILA* AND IN *MUSCA* AFTER INGESTION. Per Oftedal

(Norwegian Radium Hospital, Montebello, Norway). *Intern. J. Radiation Biol.*, 3: 222-30(Mar. 1961). (In English)

After ingestion, retention of  $Y^{91}$  citrate falls to a few per cent after two to three days in *Drosophila*, a week in *Musca*. This retained radioactivity forms a tail on the retention curve. The retention site in *Drosophila* is shown to be a narrow band of cells in the endodermal mid-gut immediately anterior to the transition to the ectodermal hind-gut. In some flies, there is also a more diffuse and somewhat wider zone containing radioactivity in the middle mid-gut. There is no activity in the pericardial cells, or in the Malpighian tubules. In *Musca* there is no activity in the pyloric region, but most of the activity is found in a region in the middle mid-gut. This zone is situated about one-third anterior from the pyloric region, and covers 10 to 25% of the total mid-gut length. Also, the pericardial structures contain some 5 to 15% of the total activity. The findings are discussed.

### 243

RADIOISOTOPES AND RADIATION IN ENTOMOLOGY. Proceedings of the Symposium on Radioisotopes and Radiation in Entomology held in Bombay, 5-9 December 1960. (International Atomic Energy Agency, Vienna). Proceedings Series. Jan. 1962. 322p. (STI/PUB/38). \$6.50 (IAEA).

Twenty-five papers are included on problems and uses of radioisotopes and radiation as tools in the fight against insects and pests, which damage agricultural crops and livestock. Twenty-four papers are abstracted, one paper on radioactive tracer techniques in insect biochemistry was previously abstracted in NSA.

### 244

INCORPORATION OF  $P^{32}$  INTO THE PHOSPHORUS COMPOUNDS OF THE WAX MOTH LARVAE (*GALLERIA MELLOANELLA*). Paulina Włodawer (Nencki Inst. of Experimental Biology, Warsaw). *Acta Biochim. Polon.*, 8: 321-35(1961). (In English)

With the aid of  $P^{32}$ , given as orthophosphate, the phosphorus metabolism in the feeding and in the starved wax moth larvae was studied. The  $P^{32}$  content of the acid-soluble P fraction, which was very high at completion of the radioisotope ingestion, fell abruptly during the subsequent period of normal feeding. The fall in the specific activity of the acid-soluble P compounds was accompanied by an increase in the specific activities of the phospholipids and nucleic acids. The phospholipid specific activity reached its maximum 24 hr. after cessation of  $P^{32}$  ingestion and exceeded the activity of the acid-soluble P fraction. Practically all of the  $P^{32}$  excreted by the larvae was found in the polyphosphates. During starvation the fall in the specific activity of the acid-soluble P fraction was less pronounced than during feeding while the changes in the specific activities of the phospholipids and the nucleic acids were rather insignificant. Uniformity of labelling was found to occur in the acid soluble P compounds of the starved but not of the fed larvae.

## GENETICS

### 245

RADIOISOTOPES AND THEIR RELATION TO THE GENETIC MECHANISM AND PHYSIOLOGICAL PROCESSES: A CRITICAL REVIEW. R. K. Appleyard (Columbia Univ., New York). p.227-39 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

## REFERENCES

Genetic considerations relevant to the presence of radioisotopes in the biosphere are reviewed. Some of the ways in which genetic constitutions of organisms may affect radioisotope burdens and their consequences are considered. Topics discussed include the genetic and species control of uptake and retention, genetic control of response, genetic hazards of irradiation of populations, radiation-induced and natural mutations, the mechanism of radiation induced mutations, transmutation experiments carried out with  $P^{32}$  and bacteriophage, the role of calcium as a necessary nuclear component, and the hazards from the transmutation and ionization produced by levels of  $C^{14}$  in the biosphere. 63 references.

246

ON THE PROBLEM OF GENETIC AND FETAL INJURY AFTER THOROTRAST INJECTION. W. Boerner, E. Moll, and A. Rummel. Strahlentherapie 113, 479-82(1960) Nov.

247

NUCLEAR THREAT AND HUMAN GENETICS. L. L. Cavalli-Sforza (Università, Pavia, Italy and Università, Parma, Italy). p.34-49 of "Exposure of Man to Radiation in Nuclear Warfare." Amsterdam, London, and New York, Elsevier Publishing Co., 1963.

Data on the genetic effects of radiation are reviewed. It is pointed out that it is impossible to estimate the genetic damage that might result from a nuclear attack since there are difficulties both in estimating mutation rates for man and in estimating the average radiation dose for survivors.

248

IMPLICATION OF CHROMOSOME STRUCTURE AND REPLICATION ON HAZARD OF TRITIATED THYMIDINE AND THE INTERPRETATION OF DATA ON CELL PROLIFERATION. Eugene P. Cronkite, Samuel W. Greenhouse, George Brecher, and Victor P. Bond (Brookhaven National Lab., Upton, N. Y.). Nature, 189: 153-4(Jan. 14, 1961).

Labeling of chromosomal desoxyribonucleic acid (DNA) with  $H^3$ -labeled thymidine ( $H^3$ TDR) demands consideration of the probabilities of long term retention of the label and damage to somatic and genetic cells. These are important for the interpretation of results and for consideration of hazards associated with the use of tritiated thymidine in human beings. The model proposed by Taylor, Woods, and Hughes permits prediction of the persistence of the label. The model is based on autoradiographic observations on plant chromosomes labeled with  $H^3$ TDR during replication. In this model each chromosome is considered to consist of two halves (chromatids), both of which replicate. If  $H^3$ TDR is available during DNA synthesis for a finite period, both half-chromosomes will be labeled in their newly formed replicas. On division, all chromosomes of the daughter cells will contain the label in the newly replicated chromatid. Subsequent DNA synthesis proceeds without further availability of  $H^3$ TDR, and newly formed replicas of both labeled and unlabeled chromatids will be unlabeled. In the daughter cells of the second division, on the average half the chromosomes will be labeled, each composed of one labeled and one unlabeled chromatid. After each subsequent division the number of labeled chromosomes per cell will be halved as the originally labeled chromatids become distributed among twice the number of cells. When the synchronously dividing progeny of a labeled cell first exceeds the chromosomal number, the fraction of labeled cells will begin to diminish, since an increasing number of cells will contain a single-labeled chromatid which cannot

subdivide, but must go to one daughter cell, leaving the other totally unlabeled. The extent of crossing-over in somatic and genetic cells of man is not known, but it is unlikely to approach a random distribution, as would be expected of exchangeability on a molecular level. Discrete distributions were computed for the human chromosome number 46 and are represented. It has not been established that the model proposed by Taylor, Woods, and Hughes pertains to mammalian chromosomes. It is now under study in tissue culture systems of human cells. If the expected agreement with the Taylor-Woods-Hughes model is confirmed, it will have a direct bearing on the interpretation of data in the study of cell proliferation, and the somatic and genetic hazard of  $H^3$ TDR in long-term work.

249

THE CONCEPT OF GENETIC LOAD: A REPLY. James F. Crow (Univ. of Wisconsin, Madison). Am. J. Human Genet., 15: 310-15(Sept. 1963).

A previously proposed concept of genetic load by Crow (Human Biol. 30, 1-13(1958) is clarified and defended.

250

CHANGES IN HEREDITY AND IN SOME PHYSIOLOGICAL AND BIOCHEMICAL INDICES UNDER THE EFFECT OF RADIOACTIVE IODINE-131. B. Eftimov, G. Konstantinov, D. Alexiev and B. Amov. Dokl. Bolg. Akad. Nauk. 16, 89-92(1963).

251

TRANSMISSION OF PHOSPHORUS-32 INCORPORATED BY PARENTS INTO DESCENDANTS OF DROSOPHILA MELANOGASTER. B. Faludi, I. Csukas, K. Szeplaky and F. A. Daniel. Nature (Lond) 190, 469(1961) Apr. 29

252

BIOSYNTHESIS OF RADIOACTIVE RNA AND DNA PYRIMIDINES FROM THYMIDINE-2- $C^{14}$ . R. M. Fink and Kay Fink (Univ. of California, Los Angeles and Veterans Administration Hospital, Long Beach, Calif.). Biochem. Biophys. Research Commun., 6: 7-10(Oct. 23, 1961).

Metabolic pathways in the synthesis of ribo- and desoxyribonucleic acids by a Neurospora mutant were investigated following replacement of thymidine used in growth experiments with thymidine-2- $C^{14}$ . Chromatograms prepared from mycelia were scanned with a Geiger counter. Data are tabulated.

253

RELATIVE RETENTION OF  $H^3$  AND  $C^{14}$  LABELS OF NUCLEOSIDES INCORPORATED INTO NUCLEIC ACIDS OF NEUROSPORA. R. M. Fink and K. Fink. J. Biol. Chem. 237, 2889-91(1962) Sept.

254

(AEC-tr-4401) LETHAL AFTEREFFECTS AFTER INCORPORATION OF  $P^{32}$  IN AMOEBA PROTEUS AND THEIR INTERPRETATION BY GENETIC SUBUNITS. H. Friedrich-Frekza and F. Kaudewitz. Translated for (Oak Ridge National Lab.) from Z. Naturforsch. 8b, 343-55 (1953). 43p. (Includes original, 9p.).

The lethal consequences of the incorporation of  $P^{32}$  were studied in a clone of Amoeba proteus grown under constant conditions. It was possible to label the individual cells without impairing motility, absorption of nutrition, and dividing capacity. Progeny of these cells were observed for 100 consecutive cell generations. The percentage of lethallities induced by  $P^{32}$  was calculated. A comparison of the results of the experiments and controls showed that the

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absorption of radioactive phosphorus by amoeba cells results in an increase of lethality in subsequent generations.

**255** RADIATION-INDUCED MUTAGENESIS—A BIOPHYSICIST'S VIEWPOINT. L. H. Gray (Mount Vernon Hospital, Northwood, Middx., Eng.). Abhandl. Deut. Akad. Wiss. Berlin, Kl. Med., No. 1, 1-19(1962).

The forms of damage to the genome that may be expressed as mutation range from gross visible re-arrangements down to an unknown lower limit is probably a change in sequence affecting a few nucleotides. Ideas concerning structural re-arrangements induced by x and  $\gamma$  radiation have to take into account the fact that the induction of a simple break in chromosomes of plants and animals is a much rarer event than was formerly supposed and that, as proposed by Revell, most of the breaks seen at a metaphase have arisen in association with the formation of exchanges. Data from which to decide whether breaks seen after exposure to densely ionizing radiation have arisen in association with exchanges or independently is lacking. Alpha radiation is efficient compared with x or  $\gamma$  radiation. Almost every transit of an  $\alpha$  particle through a plant nucleus yields an aberration visible at metaphase. Some of the mutations induced in micro-organisms by x rays as well as uv appear to be changes in the genetic material which are strictly reversible. They are invariably initiated by one ionizing particle but may not be due to energy deposition in a single site. Mutations induced by uv frequently increase in proportion to the square of the dose when the organisms are plated on to a rich medium. On other plating media, both those which depress the yield and those which augment it, the mutation frequency was found to rise almost linearly with dose. It is suggested therefore that the two sites of energy deposition indicated by the square law dependence may be concerned with quite different functions. Work has shown that mutations in spermatogonia and oöcytes by x-ray are dose-rate dependent, and also that the induction of somatic mutations in proliferating plant cells is greatly modified by exposure to a dose of 100 rad or less two hours before the test dose. These facts were examined in the light of a number of investigations which show that the ability of a gene to initiate enzyme synthesis is impaired by a dose which is not much greater than that which causes complete loss of reproductive integrity; a dose, moreover, which corresponds to the deposition of energy by a single ionizing particle anywhere in a region which represents an appreciable fraction of the genome.

**256** INCORPORATION OF PHOSPHORUS-32 INTO SALIVARY-TYPE CHROMOSOMES WHICH EXHIBIT PUFFS. Julian D. Gross. (Inst. Animal Genet., Edinburgh, Scot.). *Nature* **180**, 440(1957). CA-52-1492a.

**257** EFFECT OF COLCHICINE ON THE UTILIZATION OF THYMIDINE LABELED WITH TRITIUM DURING CHROMOSOMAL REPRODUCTION. L. F. LaCour and S. R. Pelc (John Innes Horticultural Inst., Bayfordbury, Engl.). *Nature* **183**, 1455-6(1959). CA 53-19057a

**258** GENETIC AND AUTORADIOGRAPHIC STUDIES OF TRITIATED THYMIDINE IN TESTES OF *DROSOPHILA MELANOGASTER*. W. D. Kaplan and J. E. Siskin (City of Hope Medical Center, Duarte, Calif.). *Experientia* **16**, 67-9(1960) (In English)

Autoradiographic studies were made of *D. melanogaster* larvae at various intervals after removal from a T-containing diet up to 56 hours. The preliminary data show that spermatocytes reduplicate their chromosomes very early and move posteriorly as additional cells are proliferated from the apical spermatogonia. The mutagenic effect of tritiated thymidine was studied genetically. Unquestionably the T produces a mutagenic effect.

**259** HW-59500(p.78-80)  
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

SIGNIFICANCE OF GONAD IRRADIATION IN EXPOSURE TO INTERNALLY DEPOSITED PHOSPHORUS-32. B. Kavin. 3p.

Data are presented for the retention of  $P^{32}$  in ovary and bone over a period of 56 days following single intraperitoneal administration. Concentrations of  $P^{32}$  in ovary decreased as a power function of time, while concentrations in bone remained constant throughout the period of observation. The results suggest that considerations of genetic damage may prove to be the limiting factor in determining maximum permissible limits for  $P^{32}$ .

**260** GENETIC TRANSFORMATION. I. CELLULAR INCORPORATION OF DEOXYRIBONUCLEIC ACID (DNA) ACCOMPANYING TRANSFORMATION IN PNEUMOCOCCUS. L. S. Lerman and L. T. Tolmach. (Univ. of Colorado, Denver). *Biochim. et Biophys. Acta* **26**, 68-82(1957)(In English). CA-52-1359c.

**261** GENETIC EFFECTS OF STRONTIUM-90 INJECTED INTO MALE MICE. K. G. Luning, H. Frolen, A. Nelson, and C. Ronnback. *Nature (London)* **197**, 304-5(1963) Jan. 19.

**262** CELL DIVISION: DIFFERENTIAL EFFECTS OF HEAVY WATER UPON THE MECHANISMS OF CYTOKINESIS AND KARYOKINESIS IN THE EGGS OF *ARBACIA PUNCTULATA*. D. Marsland and A. M. Zimmerman. *Exp. Cell. Res.* **30**, 23-35 (1963) Mar.

**263** A/CONF.15/P/1351  
MUTATIONS OF RICE INDUCED BY RADIOISOTOPE  $^{32}P$ . Isao Masima and Takeshi Kawai (National Inst. of Agricultural Sciences, Japan). 17p.

The mutagenic effect of internal radiations from absorbed phosphorus-32 was examined in rice plants. Characteristics of the radioinduced mutants were investigated to see whether the induced mutations were suitable for plant breeding. Two-hundred and eighty-three mutant lines were obtained which bred true with different characters in the fourth and fifth generation. Field trials over a six year period resulted in some promising lines having high productivity. Some physiological and genetic effects of phosphorus-32 are described. Data are tabulated on yields and characteristics of mutant lines.

**264** GENETIC CONTROL OF PHYSIOLOGICAL PROCESSES: CONSIDERATION OF DIFFERENTIAL ION UPTAKE BY PLANTS. W. M. Myers (Rockefeller Foundation and Indian

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Agricultural Research Inst., New Delhi, India). p.201-26 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Differences among species in content of important elements, in their absorption through roots and foliage, and in their transport from roots to aerial parts have been reported by many investigators. Data on chemical composition must be interpreted with caution since composition is influenced so much by factors of environment, stage of maturity of the plant, and plant part analyzed. Nevertheless, there is little doubt that some of the differences among species are attributable to the species themselves, i.e., to their genetic constitution. The somewhat more limited data on variations within species further substantiates the conclusion that genetically controlled differences do exist in content of various elements and in physiological processes involved in their uptake, transport and metabolism. 86 references.

**265** INDUCTION OF MUTATIONS AND KILLING OF CELLS IN IRRADIATED SPERMATOGONIA OF DROSOPHILA. Per Oftedal (Norsk Hydro's Inst. for Cancer Research, Montebello, Norway). *Nature*, 199: 1301-2 (Sept. 28, 1963).

In previous experiments Drosophila melanogaster spermatogonia were irradiated in the 20-hr embryo, the induction of sex-linked recessive lethals was observed, and a nonlinear dose effect curve was found. In an attempt to explain the results quantitatively, a mathematical model for the irradiated population of spermatogonia was formulated and tested at doses of 144 and 267 r. Results seemed to support the hypothesis of differential killing as an explanation for the results after acute irradiation of spermatogonia. It was found that protracted irradiations under some conditions may have a higher observable genetic effect than acute treatments.

**266** GENETIC AND SOMATIC EFFECTS OF CARBON-14. Linus Pauling (California Inst. of Tech., Pasadena). *Science* 128, 1183-6(1958) Nov. 14

On the basis of information about carbon-14 given by Libby, calculations are made of the predicted genetic and somatic effects of the carbon-14 produced by the testing of nuclear weapons. It is concluded that 1 year of testing (30 megatons of fission plus fusion) is expected to cause in the world (estimated future number of births per year 5 times the present number) an estimated total of about 55,000 children with gross physical or mental defects, 170,000 stillbirths and childhood deaths, and 425,000 embryonic and neonatal deaths. (There is an unknown amount of overlap of these three categories.) These numbers are about 17 times the numbers usually estimated as the probable effects of the fallout fission products from 1 year of testing. In addition, the somatic effects of bomb-test carbon-14 are expected to be about equal to those of fission products, including strontium-90, with respect to leukemia and bone cancer and greater than those of fission products with respect to diseases resulting from radiation damage to tissues other than bone tissue and bone marrow. All of the estimated numbers are subject to great uncertainty; they may be as much as 5 times too high or 5 times too low. The uncertainty in the estimation of the relative effects of carbon-14 and fission products in world-wide fallout is not so great.

**267**

ANTIVIROGENETIC POWER OF NORMAL AND NEOPLASTIC HUMAN CELLS AND CELLULAR FRACTIONS CULTIVATED IN VITRO. INVESTIGATIONS WITH RADIOPHOSPHORUS-32P. A. Pellegrini, A. M. Passaggio and P. G. Pagano. *Minerva Nucl.* 4, 88-91(1960) Feb.-Mar.

**268**

CHROMOSOMAL SYNTHESIS OF RIBONUCLEIC ACID AS SHOWN BY INCORPORATION OF URIDINE LABELLED WITH TRITIUM. G. Pelling. *Nature (Lond)* 184, (Suppl. 9), 655-6(1959) Aug. 22.

**269**

DISTRIBUTION OF CYTOLOGICAL ABERRATIONS AFTER GAMMA IRRADIATION. Guru D. Pershad, S. A. Krane, C. C. Bowen, and H. T. David (Ames Lab., Ames, Iowa). *Radiation Research*, 14: 184-91(Feb. 1961).

Microsporocytes of four horticultural varieties of Lilium longiflorum were exposed to 20, 40, and 60 r of  $\text{Co}^{60}$   $\gamma$ -irradiation at pachytene and diakinesis. Bridges and fragments were scored at anaphase I. It was observed that the total damage failed to follow the Poisson distribution. When the analysis was modified on the assumption that only a certain proportion of the damaged cells were scored, an excellent fit was obtained to the Poisson distribution. It is suggested that cells with one or more bridges or fragments might take longer to reach anaphase than cells with no visible damage, and consequently such lagging cells are less apt to be scored.

**270**

THE HARMFUL GENETIC EFFECTS OF RADIATION. Harold H. Plough (Amherst Coll., Amherst, Mass.). *J. Natl. Med. Assoc.*, 54: 652-7(Nov. 1962).

Evidence relating to the injurious mutagenic effects of ionizing radiation on biological systems is considered from the point of view of animal experimentation and its pertinence to the increasing radiation burden of human populations. Most evidence for harmful genetic effects from at least the higher doses of radiation comes mainly from studies on Drosophila and the mouse. As in Drosophila, mutations in the mouse appear in linear relation to the dose. One difference in the mouse is that the same radiation dose delivered over a longer period produces fewer mutations than higher intensities. This suggests that some repair may occur during chronic doses at the lower rates. It is pointed out that such data may only be converted into estimates of total radiation damage per roentgen from the total number of genes and the demonstration that the mutations observed, whether lethals or selected visibles, show sensitivities which are average for all genes. The average induced rate for the mouse has been calculated to be  $21.3 \times 10^{-8}$  per gene per r, and for certain specific loci in Drosophila the value is  $\sim 1.5 \times 10^{-8}$ , suggesting that the mammal is about 16 times more sensitive than the insect. From similar data it was calculated that the dose which would double the natural mutation rate for both flies and mice is about 40 r. This is a convenient figure, and may be used for men on the basis of tabulated spontaneous mutation rates. It is suggested that minor increases in the mutation frequency from low level radiation are imaginary hazards, and that a slight increase in selection would remove many of the harmful mutants as they appear. There is some reason to believe that minor genetic changes are corrected at the cellular level. This position is discussed in terms of recent changes in gene theory relating to microbial genetics. This reveals evidence for a mechanism of repair of radiation damage at the level

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of the smallest genetic units. It is possible, or even probable, that such a mechanism operates in premeiotic stages between genes in heterozygous condition in higher organisms. Critical tests have not yet been made, but they might show reduced expression of lethals or semilethals in subsequent generations after radiation, as compared with the results at higher doses. They might appear as so-called conversion which might be interpreted as crossing over by partial replication. It is concluded that the genetic hazards of radiation are overemphasized and that minor deleterious mutations are selected out early or are repaired before they appear.

271

RADIOISOTOPES AND THE GENETIC MECHANISM: ISOTOPIC TRANSMUTATION AND BIOCHEMICAL FUNCTION. David Pratt (Univ. of California, Berkeley). p.123-31 of "A Symposium on Radioisotopes in the Biosphere." Richard S. Caldecott and Leon A. Snyder, eds. Minneapolis, University of Minnesota, 1960.

Incorporated radiophosphorous,  $P^{32}$ , inactivates either bacterial viruses or *Escherichia coli* bacteria by means of radioactive disintegrations which take place in their DNA. Of all radioactive disintegrations in the genetic substance, approximately one tenth actually inactivate. Their recoil energy breaks the DNA molecule in which they occur. This  $P^{32}$  decay induced death can be used as an experimental tool to study gene function and reduplication.

272

STABILIZATION TO PHOSPHORUS-32 DECAY AND ONSET OF DNA REPLICATION OF  $T_4$  BACTERIOPHAGE. D. Pratt, G. S. Stent, and P. D. Harriman. *J. Molec. Biol.* 3, 409-24(1961) Aug.

273

RESISTANCE TO CHOLINESTERASE INHIBITORS OF THE ORGANOPHOSPHORUS GROUP IN DIFFERENT STRAINS OF *DROSOPHILA MELANOGASTER*. GENETICAL AND ENZYMIC STUDIES. B. Rasmuson and B. Holmstedt (Roy. Agr. Coll. Sweden, Uppsala). *Kgl. Lantbruks-Högskol. Ann.* 24, 89-99(1958). CA 53-85221

274

INCORPORATION OF  $H^3$ -CYTIDINE AND  $H^3$ -THYMIDINE INTO GIANT CHROMOSOMES OF *DROSOPHILA* DURING PUFF FORMATION. Geo. T. Rudkin and Philip S. Woods (Inst. for Cancer Research, Philadelphia, Pa.). *Proc. Natl. Acad. Sci. U.S.* 45, 997-1003(1959). CA 53-22546a

275

RELATIVE BIOLOGICAL EFFECTIVENESS OF BETA-RAYS EMITTED FROM PHOSPHORUS-32. I. COMPARISON OF BIOLOGICAL EFFECTS OF PHOSPHORUS-32 BETA-RAYS AND X-RAYS ON *DROSOPHILA MELANOGASTER* EGGS. T. Rudnicki. *Acta Physiol. Pol.* 12, 145-57(1961) Jan.-Feb.

276

THE CONCEPT OF GENETIC LOAD: A CRITIQUE. L. D. Sanghvi (Univ. of Michigan, Ann Arbor). *Am. J. Human Genet.*, 15: 298-309(Sept. 1963).

Difficulties in accepting a provocative scheme by Crow (Human Biol. 30, 1-13(1958) to evaluate the relative importance of mutational and segregational loci in maintaining our hereditary burden are discussed. The genotype used as standard of comparison in the previously developed mutation model is not the same as the one used in his segregation model. A logical approach will require a fixed

standard of comparison for the two models. A scheme is outlined in which the same genotype is used for evaluating the inbreeding effects on the two types of loci. It turns out that the appropriate test criterion for this purpose should be  $1 - B/1 - A$  and not  $B/A$  as previously suggested. Other points related to the concept of genetic load are also discussed.

277

BIOCHEMICAL MUTATIONS IN *TORULOPSIS UTILIS* FOLLOWING THE ACTION OF IONIZING IRRADIATIONS. E. N. Sokurova and T. M. Volkova. *Radiobiologia* 2, 36-42(1962)

278

GENETICAL EFFECTS OF RADIATION. A. C. Stevenson (Medical Research Council, Oxford). p.73-93 of "Exposure of Man to Radiation in Nuclear Warfare." Amsterdam, London, and New York, Elsevier Publishing Co., 1963.

The survivors of a nuclear disaster would be a very heterogeneous group in respect to dosage and therefore in respect to temporary or permanent sterility and transmissible damage induced in their germ cells. Possible genetic effects of radiation from a nuclear attack in human populations are discussed.

279

MUTAGENIC EFFECT OF  $C1^4$  AND  $H^3$  LABELLED DNA PRECURSORS INJECTED INTO *DROSOPHILA MELANOGASTER* MALES. O. Stromnaes. *Canad. J. Genet. Cytol.* 4, 440-6(1962) Dec.

280

[THE PROCESSES INVOLVED IN GENETICS AND OTHER CELL PROCESSES]. Statement of Dr. J. Herbert Taylor (Columbia Univ., New York). p.304-14 of "Applications of Radioisotopes and Radiation in the Life Sciences."

Applications of tritium as a tracer in studies of the incorporation of thymidine into deoxyribonucleic acid are discussed. Radioautography was used to illustrate the results of chromosome labeling, the distribution of tritium to daughter chromosomes during division, and the order of chromosome reproduction in cells.

281

MODE OF CHROMOSOME DUPLICATION IN *CREPIS CAPILLARIS*. J. H. Taylor (Columbia Univ.). *Exptl. Cell Research* 15, 350-7(1958). CA 53-22271g

282

TRITIUM AND AUTORADIOGRAPHY IN CELL BIOLOGY. J. H. Taylor (Columbia Univ., New York). p.221-8 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

Because tritium emits low-energy beta radiation, it is the most useful isotope for high-resolution autoradiography. The relative abundance of hydrogen in most biologically important substances combined with a relatively short half life allows the labeling of cellular components at specific activities that can often be detected at intracellular dimensions by the use of nuclear emulsions. The cells are attached to glass by various cytological procedures and after fixation a wet or fluid photographic emulsion is applied directly to the cell surface and allowed to dry. After exposure the emulsion is developed while still in contact with the biological specimen. The preparation, an autoradiogram, when viewed under the light microscope shows the cellular structures and the location of the isotope

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with a resolution of less than  $1\text{ }\mu\text{m}$ . In this way, the distribution of tritium-labeled deoxyribonucleic acid (DNA) of individual chromosomes was traced through two to three cell divisions. These studies were made possible by the preparation of tritiated thymidine which is a highly selective label for DNA and is quickly depleted when the cell is removed from the environment containing the labeled thymidine. The technique yielded information on the mechanism of DNA replication, structure and reproduction of chromosomes, kinetics of cell division, and, more recently, on the patterns and time sequence in the reproduction of different chromosomes in the same nucleus and the different parts of a single chromosome. All chromosomes studied so far contain two functional sub-units of DNA which are distributed in a semi-conservative fashion during reproduction. The two sub-units are unlike in some structural sense that limits the type of exchanges that may occur among the four sub-units of a reproducing chromosome. Present evidence on sequences leads to the hypothesis that chromosomes reproduce in a genetically controlled sequence. Further evidence on the patterns and mechanism of control of the sequence are being sought along with other related processes that involve the synthesis of chromosomal proteins and the other class of nucleic acids, ribonucleic acids.

**283** COMPARISON OF EFFECTS OF ATOM DECAY AND BETA-RAY RADIATIONS ON THE INACTIVATION AND MUTATION OF A MYCOBACTERIUM. Michio Tsukamura (Obuso National Sanatorium, Obu, Japan). *Genetics*, 46: 1561-4 (Dec. 1961).

The effects of  $\text{P}^{32}$  and  $\text{Sr}^{90}$  added to culture media were compared in a Mycobacterium to determine whether decay of atoms or intracellular beta radiations takes an important role in causing inactivation and mutation. Both inactivation and mutation occurred significantly in a culture grown in medium containing  $1\text{ }\mu\text{C}\text{ P}^{32}/\text{ml}$ , and only a moderate increase of mutations occurred without inactivation of cells in a culture grown in medium containing  $20\text{ }\mu\text{C}\text{ Sr}^{90}/\text{ml}$ . No significant increase of mutation was seen in a culture grown in medium containing  $2\text{ }\mu\text{C}\text{ Sr}^{90}/\text{ml}$ . Since large amounts of intracellular and extracellular beta radiations from  $\text{Sr}^{90}$  were found to be ineffective in causing inactivation of cells and much less effective in causing mutation than is true for a small amount of  $\text{P}^{32}$ , it is conceivable that inactivation and mutations occurring in cells grown in medium containing such a small amount of  $\text{P}^{32}$  ( $1\text{ }\mu\text{C}\text{ P}^{32}/\text{ml}$ ) are due neither to intracellular nor extracellular beta-ray radiations but mostly to decay of  $\text{P}^{32}$  atoms incorporated into cells.

**284** INACTIVATION AND MUTATIONS IN MYCOBACTERIUM AVIUM BY DECAY OF INCORPORATED RADIOACTIVE PHOSPHORUS. Michio Tsukamura (Obuso National Sanatorium, Obu, Japan). *Genetics*, 46: 911-24 (Aug. 1961).

Inactivation and mutation occurred in Mycobacterium Jucho by decay of incorporated radioactive phosphorus ( $\text{P}^{32}$ ) under the conditions in which cells labeled with  $\text{P}^{32}$  were stored in freezing state during the progress of  $\text{P}^{32}$  decay, and the existence of any selective process of marker mutants could be excluded. Relationships between the inactivation and mutations and the intracellular distribution of  $\text{P}^{32}$  were studied. Fractionation of radioactive cells was also performed. Inactivation of cells was much more markedly affected by the amount of  $\text{P}^{32}$  in the DNA fraction

than by the amount of total radioactivity of cells that parallels the amount of beta-ray irradiation. Inactivation curves, survival curves plotted as a function of the amount of  $\text{P}^{32}$  decay, tended to be exponential, if the DNA fraction was labeled heavily by  $\text{P}^{32}$ . It is suggested that beta-ray irradiation is not responsible for inactivation of bacterial cells and decay of  $\text{P}^{32}$  in the DNA fraction, but that change of  $\text{P}^{32}$  into  $\text{S}^{32}$  in DNA structure is mainly responsible for it. If cells were labeled by  $\text{P}^{32}$  representing a relatively low content of  $\text{P}^{32}$  in the DNA fraction, inactivation of cells occurred showing decay-survival curves of a multihit type. Thus, it is also suggested that inactivation of cells may occur also by decay of  $\text{P}^{32}$  in multiloci outside of the DNA. Mutation frequency to isoniazid resistance was rapidly increased with progress of  $\text{P}^{32}$  decay, while mutation frequency to streptomycin resistance was not increased or only slightly increased. Thus, a marked discrepancy between these two mutations was observed. Mechanism of this discrepancy was discussed. The incidence of mutation (to isoniazid resistance) did not parallel the amount of total radioactivity of cells that corresponded to the amount of beta-ray irradiation. The induced mutation was increased roughly in accordance with the progress of  $\text{P}^{32}$  decay. It is conceivable that the induced mutation also occurs by decay of incorporated  $\text{P}^{32}$ .

**285** MUTAGENIC EFFECT OF CONTINUOUS IRRADIATION BY PHOSPHORUS-32 OF MYCOBACTERIUM AVIUM AND INFLUENCES OF STREPTOMYCIN AND SULFATHIAZOLE ON THIS EFFECT. Michio Tsukamura, Takashi Abo, and Rokuro Katsumura. (Obuso Natl. Sanatorium, Obu, Aichi-ken). *Nippon Saikingaku Zasshi* 12, 853-6 (1957). CA-53: 3365f.

**286** ON THE PHYSIOLOGICAL AND MUTAGENIC ACTION OF D2-O ON DROSOPHILA MELANOGASTER. V. G. Tumanian and S. E. Shnol'. *Biofizika* 8, 15-8 (1963)

**287** CHROMOSOME BREAKAGE PRODUCED BY TRITIUM-LABELED THYMIDINE IN TRADESCANTIA PALUDOSA. Donald E. Wimber (Brookhaven National Lab., Upton, N. Y.). *Proc. Natl. Acad. Sci. U. S. A.* 45, 839-46 (1959) June.

The fragmentation of chromosomes in the root tips of *Tradescantia paludosa* as produced by tritium-labeled thymidine was measured. As many as 31 fragments per 100 cells occurred in roots grown for 4 to 8 hours in  $1$  or  $2\text{ }\mu\text{C}/\text{ml}$   $\text{H}^3$ -thymidine and then transferred to isotope-free solutions for further growth before collection. The highest fragment frequency could be correlated with the period during which the maximum amount of  $\text{H}^3$ -thymidine was incorporated into the chromosomes. Up to 72 fragments per 100 cells at anaphase were demonstrated after continuous exposure of root tips to  $1\text{ }\mu\text{C}/\text{ml}$   $\text{H}^3$ -thymidine for times up to 56 hours. The mitotic index dropped sharply in roots that had been exposed to  $1\text{ }\mu\text{C}/\text{ml}$  of  $\text{H}^3$ -thymidine for periods over 8 hours. Cells that absorb large quantities of  $\text{H}^3$ -thymidine as indicated by autoradiographs are seemingly disturbed in their development and are delayed or prevented from entering mitosis. Autoradiographs of roots that had been exposed to  $1\text{ }\mu\text{C}/\text{ml}$   $\text{H}^3$ -thymidine for 24 to 56 hours showed that the average grain count over dividing nuclei increased as the fragmentation appearing at anaphase

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increased. Approximations of the dose delivered to the nuclei by the endogenous radiation from the tritium were made by two different methods; however, the estimates showed poor agreement. Confident calculations of the dose probably await the determinations of the efficiency of the  $\beta$  rays in producing an autoradiograph. These findings would indicate that investigators utilizing tritiated substances should interpret their results with caution for the endogenous radiation delivered to a cell may be great enough to cause considerable chromosome breakage and presumably other forms of genetic damage as well as significant changes in cellular physiology.

## IMMUNOLOGY

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IMMUNIZATION AFTER INTRAVENOUS INJECTION OF SMALL AMOUNTS OF Cr-51 LABELLED RED CELLS. P. L. Adner, S. Foconi, and S. Sjölin. *Brit. J. Haemat.* **9**, 288-98(1963) July

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FORMATION OF SPECIFIC ANTIBODIES AND  $\gamma$ -GLOBULIN IN VITRO. A STUDY OF THE SYNTHETIC ABILITY OF VARIOUS TISSUES FROM RABBITS IMMUNIZED BY DIFFERENT METHODS. Brigitte A. Askonas and J. H. Humphrey. (Natl. Inst. Med. Research, London). *Biochem. J.* **68**, 252-61 (1958). CA-52: 9370a.

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THE EFFECTS OF X-IRRADIATION ON THE PREVENTIVE ACTIVITY OF THE HOST AGAINST BACTERIAL INFECTION. III. INACTIVATION IN THE RETICULO-ENDOTHELIAL SYSTEM BY X-IRRADIATION AND THE EFFECT OF RADIOISOTOPE PHOSPHORUS-32. Shigemitsu Awataguchi (Tokyo Univ. School Med.). *Nippon Saikingaku Zasshi* **13**, 398-402(1958). CA 53-18118f

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IN VIVO PURIFICATION OF IODINE-131-LABELLED LOCALIZING ANTIRAT LYMPHOSARCOMA ANTIBODY. Wm. F. Bale, Irving L. Spar, and Ruth L. Goodland. (Univ. of Rochester, Rochester, N. Y.). *J. Immunol.* **80**, 482-94(1958). CA-52: 15712h.

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PREPARATION AND PURIFICATION OF HUMAN INSULIN- $I^{131}$ ; BINDING TO HUMAN INSULIN-BINDING ANTIBODIES. Solomon A. Berson and Rosalyn S. Yalow (Veterans Administration Hospital, Bronx, N. Y.). *J. Clin. Invest.*, **40**: 1803-8(Oct. 1961).

The preparation of  $I^{131}$ -labeled human insulin from a lot of human insulin containing approximately 25% insulin by weight and its purification from labeled contaminants are described. The reaction of human insulin- $I^{131}$  with insulin-binding antibodies in the serums of human subjects treated with commercial mixtures of animal insulins is demonstrated directly. Comparison of the binding of human insulin and beef insulin in antisera from eight insulin-resistant and nonresistant diabetic subjects revealed a lesser affinity of antibody for human than for beef insulin in most cases, but considerable variability in this respect was encountered among different antisera.

293

THE DEVELOPMENT OF ANTIBODIES IN WHITE RATS IMMUNIZED AGAINST INFLUENZA, UNDER THE INFLUENCE OF RADIATIONS EMITTED BY IODINE-131 AND PHOSPHORUS-32. O. Burducea, M. Cepleanu, and R. Caprarur. *Stud. Cercet. Inframicrobiol.* **12**, 137-42(1961)

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THE ELECTROPHORETIC STUDY OF SERA FROM ANTI-INFLUENZA IMMUNIZED RATS TREATED WITH RADIO-PHOSPHORUS (P-32) AND RADIOIODINE (I-131). O. Burducea, I. Samuel, and M. Cepleanu. *Stud. Cercet. Inframicrobiol.* **13**, 89-96(1962)

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CONTRIBUTION TO THE KNOWLEDGE OF THE ANTI-THYROID ACTIVITY OF SOME SUBSTANCES WITH ANTITUBERCULAR ACTIVITY. RESEARCH WITH RADIOIODINE. P. Carenza and A. Girolami. *Arch. Tisiol.* **14**, 1218-30(1959) Dec.

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THE RELATIVE BINDING OF CALCIUM AND STRONTIUM WITH SERUM PROTEINS AND OTHER SUBSTANCES. Charles W. Carr, Leon Singer, and Francis A. Spurrell (Univ. of Minnesota Medical School, Minneapolis and Univ. of Minnesota, St. Paul). *Proc. Soc. Exptl. Biol. Med.*, **110**: 80-3(May 1962).

Sera from various mammalian species, solutions of various fractions of serum proteins, and solutions of certain other substances were tested by ultrafiltration in the presence of  $Ca^{45}$  and  $Sr^{85}$  for their binding of Ca, and Sr. For 6 species, human, dog, horse, cow, sheep, and rat, the ratio, Ca bound/Sr bound, was 1.29, 1.14, 1.19, 1.15, 1.17, and 1.13, respectively. The absolute degree of binding shown by these species falls into 2 groups. The human, dog, and horse sera bound the 2 ions to a lesser extent, 57% Ca and 47% Sr; cow, sheep, and rat sera bound the ions to a greater extent, 69% Ca and 60% Sr. Ultrafiltration of various serum protein fractions of the human and bovine revealed that fraction V (albumin) showed no difference between the binding of Ca and Sr but differences were noted with the globulin fractions (IV, III, II) that could account for the discrimination observed in whole serum. Results of the ultrafiltration of a variety of other proteins and polyelectrolytes led to the speculation that mucoproteins in the serum globulins could account for the large fluctuations in binding of both ions by globulin fractions of various species; however, the results did not show any indication of the type of substance or chemical grouping which could account for the slight but persistent discrimination between Ca and Sr that has been observed in whole serum.

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RESEARCH ON THE EFFECT OF STERILIZING DOSES OF COBALT-60 GAMMA RAYS ON ANTIBACTERIAL SERA. O. V. Chakhava. *J. Hyg. Epidem. (Praha)* **4**, 196-206(1960)

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EXPERIMENTAL STUDIES ON THE EFFECT OF AUTO-ANTIBODIES AGAINST X-RAY IRRADIATED LUNG TISSUE UPON TISSUE RESPIRATION AND THE TISSUE ATP-SYSTEM ( $P^{32}$ -INCORPORATION) OF LUNG. S. Chiba (Iwate Medical Coll., Morioka, Japan). *Nippon Igaku Hoshasen Gakkai Zasshi*, **20**: 1448-75(1960).

Tissue respiration of the irradiated right lung of rabbits was inhibited to a degree which was parallel to the magnitude of the dose from 2000 to 50 r. The non-irradiated left lung, however, also showed similar changes. This was



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considered to be caused by auto-antibodies produced in large quantities. A decrease of ATP and increase of ADP in the tissues of the irradiated lung were observed. These findings were also seen in the non-irradiated lung of rabbits. Considerable inhibition of incorporation of  $P^{32}$  of the ATP-system was noted both in the irradiated and the non-irradiated lung of rabbits. It is postulated that auto-antibodies which were produced by x-irradiation of the lung had a definite inhibitory action of the lung. (Abstr. Japan Med., 2, No. 2, Feb. 1962).

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RESEARCH ON THE IMMUNOLOGICAL STATE OF GUINEA PIGS PREVACCINATED WITH BCG OR PREINFECTED WITH H37Rv AT VARIOUS PERIODS OF TIME. (EXPERIMENTAL RESEARCH WITH TUBERCLE BACILLI "LABELED" WITH RADIOPHOSPHORUS). G. Curci and A. Ninni. *Arch. Tisiol.* 17, 469-80 (1962) June. (It)

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IMMUNOCHEMICAL STUDY OF IODINE-131 LABELED SPUTUM PROTEINS: ELECTROPHORETIC, AUTORADIOGRAPHICAL AND IMMUNOLOGICAL RESEARCH. A. D'Addabbo. *Minerva Nucl.* 6, 301-10 (1962) Oct.

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THE RELATION OF THE RATES OF SERUM PROTEIN METABOLISM, HETEROLOGOUS SERUM PROTEIN CATABOLISM, AND THE TIME AND MAGNITUDE OF THE ANTIBODY RESPONSE. Frank J. Dixon and Wm. O. Weigle. (Univ. of Pittsburgh, Pittsburgh, Pa.). *Ann. N.Y. Acad. Sci.* 70, 69-71 (1957). CA-52-3984h.

302 (JPRS-5761(p.189-91)) THE COURSE OF EXPERIMENTAL TUBERCULOSIS UNDER CONDITIONS OF THE EFFECT OF RADIOACTIVE PHOSPHORUS. E. D. Dubovyi (Ye. D. Duboy), L. B. Aksel'rod, N. D. Golban, A. A. Konshin, and E. P. Tsyban. Translated from *Med. Radiol.* 5, No. 7, 71 (1960).

The immunological mechanisms in animals infected with tuberculosis were found to be greatly reduced after the administration of large doses of  $P^{32}$ . The administration of small doses of  $P^{32}$  caused a more favorable course of tuberculosis than that observed in controls.

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IMMUNOLOGICAL STUDIES WITH I-131-LABELED ANTIGEN IN EXPERIMENTAL UVEITIS. *AMA Arch. Ophthal.* 63, 515-39 (1960) March

304 IODINE-125 AS A PROTEIN LABEL IN IMMUNOLOGY. Frank W. Fitch, James Winebright, and Paul V. Harper (Argonne Cancer Research Hospital, Chicago). *Science*, 135: 1068-9 (Mar. 23, 1962).

Advantages of using  $I^{125}$  as a protein label in immunology are given. The 60-day half-life provides long shelf life for labeled materials, and the low energy dissipation rate, approximately 15% that of  $I^{131}$ , greatly reduces radiation damage to tagged compounds. Formalin-killed *Salmonella typhosa* bacilli were iodinated with  $I^{125}$  and injected intravenously into rats. Tissues sampled for measurement of radioactivity and for autoradiography showed an average of 77% of the injected radioactivity was present in the liver and 2.5% in the spleen.

305

THE USE OF RADIOACTIVE ISOTOPES IN IMMUNOLOGICAL INVESTIGATIONS. THE ROLE OF LEUCOCYTES AND NON-PLASMA ANTIBODY IN THE REMOVAL OF ANTIGENIC PROTEINS FROM THE BLOOD STREAM OF IMMUNIZED RABBITS. G. E. Francis and J. D. Hawkins (St. Bartholomew's Hospital, London). *Biochem. J.* (London) 69, 287-97 (1958) June.

Bovine plasma albumin and horse serum labeled with iodine-131 were employed in studies on the behavior and elimination of intravenously injected native proteins in normal and immune rabbits. Actively, but not passively, immunized rabbits can eliminate rapidly from their blood more antigen than their sera can precipitate *in vitro*, except when they have been in the immune state for a long time. When immune rabbits are given an injection of antigen sufficient to react with all the antibody in their plasma, a second small injection of antigen is eliminated from the blood more rapidly than a similar dose injected into normal rabbits. There is evidence for deposition of part of the second injected dose in the liver, lungs, and spleen of the immune rabbits. The significance of these observations is discussed and it is concluded that some non-plasma antibody is partly responsible for the immune responses observed when an antigen is injected into specifically immunized rabbits. This non-plasma antibody is unlikely to be mainly in the lymphocytes or lymphoid tissue. Injection of antigen into immune, but not into normal, rabbits causes a profound leucopenia, which is due to a fall in the numbers of both lymphocytes and granulocytes. This phenomenon is not modified by the prior injection of cortisone in amounts sufficient to cause a lymphocytopenia.

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PRECIPITATION OF RADIOLABELED POLIOVIRUS WITH SPECIFIC ANTIBODY AND ANTIGLOBULIN. R. K. Gerloff, B. H. Hoyer, and L. C. McLaren. *J. Immun.* 89, 559-70 (1962) Oct.

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A GENERAL METHOD FOR THE QUANTITATION OF IMMUNE CYTOLYSIS. Harold S. Goodman (Univ. of Chicago). *Nature*, 190: 269-70 (Apr. 15, 1961).

A test using  $Cr^{51}$ -labeled cells was developed for quantitative measurements of immune lysis for cells derived from a variety of tissues. Procedures are described and data are tabulated from typical measurements of antibody cytolytic activity in tumor cells

308

THE BEHAVIOR OF RADIOACTIVE-LABELLED ANTIGENS TOWARD BLOOD ERYTHROCYTE ELEMENTS. V. DETERMINATION OF THE SURVIVAL TIME OF HOMOLOGOUS ERYTHROCYTES AFTER IN VITRO LOADING WITH S-35-LABELLED ALCOHOL DEHYDROGENASE AND  $Cr^{51}$ -LABELLED POLYSACCHARIDES. F. Gramlich, J. Fischer and D. Mohring. *Klin. Wschr.* 40, 955-9 (1962) Sept.

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EFFECT OF IMMUNIZATION WITH TWO ANTIGENS ON ANTIBODY CONTENT AND RATE OF GLYCINE- $C^{14}$  INCLUSION INTO ANTIBODIES. A. E. Gurvich and N. P. Smirnova. *Biochemistry (U.S.S.R.)* 22, 584-92 (1957) (English translation). CA-52: 13964f.

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- 312** USE OF  $C^{14}$ -AMINO ACIDS TO STUDY SITES AND RATES OF ANTIBODY SYNTHESIS IN LIVING HYPERIMMUNE RABBITS. J. H. Humphrey and B. D. Sulitzeanu. (Natl. Inst. Med. Research, London). Biochem. J. 68, 146-61(1958). CA-52: 7484h.
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- 314** CELLULAR IMMUNITY CHANGES IN CHRONIC CONTINUOUS ACTIVITY OF IONIZING RADIATIONS. P. N. Kiselev and P. A. Buzini. Med. Radiol. (Moskva) 7, 59-65(1962) Aug.
- 315** INFLUENCE OF CONTINUOUS AND PERMANENT EXPOSURE TO SMALL DOSES OF IONIZING RADIATION ON HUMORAL AND CELLULAR IMMUNITY. P. N. Kiselev and P. A. Buzini. Radiobiol. Radiother. 1, 189-96(1960) Oct.-Nov.
- 316** CHARACTERIZATION OF COMPLEXES WHICH CONTAIN DIPHTHERIA TOXIN AND HUMAN NON-PRECIIPITATING ANTITOXIN. W. J. Kuhns, S. P. Masouredis, and L. Swabey (Univ. of Pittsburgh, Pittsburgh, Pa.). J. Immunol. 82, 226-31(1959). CA 53-11596b
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- 321** EFFECTS OF WHOLE-BODY  $Co^{60}$  IRRADIATION ON THE ELIMINATION OF AN  $I^{131}$ -LABELED ANTIGEN. I. STUDY OF THE SENSITIZATION PHENOMENON. F. Piccotti, G. L. Sannazzari, and A. Torretta (Università, Turin). Minerva Fisioterap., 7: 312-20(Nov.-Dec. 1962). (In Italian)  
Adult rabbits were sensitized by intradermal injection of 10  $\mu$ g human serum albumin (HSA), and in some cases exposed 12 hr later to 500-r  $\gamma$  radiation. In other animals irradiation preceded injection of antigen by 12 hr, some received radiation only, and others no treatment. Eight days later  $I^{131}$ -labeled HSA was injected intravenously and its rate of elimination from the circulation followed by serial assays of blood radioactivity. In rabbits receiving no treatments, HSA- $I^{131}$  in blood fell to 14% of the initial level and then, at a more rapid rate, to 0.2% by the 7th day. Faster (immune) elimination of antigen was noted in the sensitized rabbits, only 1.2 and 0.14% remaining by the 4th and 5th days. Elimination of antigen was considerably slowed in rabbits receiving irradiation alone, with 18% remaining on the 4th and 0.14% on the 10th day, showing the inhibitory effect of irradiation on the nonimmune mechanisms for removing foreign protein from the circulation. Rabbits irradiated 12 hr after sensitization cleared the antigen from the blood much faster (0.8 and 0.2% remaining at 4 and 5 days) than those irradiated before (12 and 6% at 4 and 5 days) and slightly faster than sensitized but nonirradiated rabbits. The results indicate that antibody is rapidly synthesized after introduction of antigen and that midlethal irradiation 12 hr later does not impair the immune mechanisms for removal of the antigen from the circulation when it is reintroduced 8 days later. In contrast, irradiation before sensitization abolishes the immune mechanism for elimination of antigen.
- 322** A COMPARISON OF FLUORESCCEIN AND IODINE-131 AS LABELS FOR DETERMINING THE IN VIVO LOCALIZATION OF ANTITISSUE ANTIBODIES. David Pressman, Yasuo Yagi, and Raymond Hiramoto (Roswell Park Mem. Inst., Buffalo, N. Y.). Intern. Arch. Allergy Appl. Immunol. 12, 125-36(1958). CA 53-8257i
- 323** CONTINUOUS COBALT-60 IRRADIATION AND IMMUNITY TO INFLUENZA VIRUS. J. J. Quilligan, Jr., et al. J. Immun. 90, 506-11(1963) Apr.
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THE BEHAVIOR OF TRACE-LABELLED ANTIGEN IN PAPER ELECTROPHORESIS IN THE PRESENCE OF ANTISERA. Jim Rhodes, E. Sorkin. *Scand. J. Clin. Lab. Invest.* 12, 38-46(1960)

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USE OF RADIOACTIVE ISOTOPES IN EXPERIMENTAL IMMUNOLOGY. Miroslav Simić. *Primena Radioaktiv. Izotopa i Jonizujucih Zracenja u Med.*, 2: No. 3, 25-32(Dec. 1961). (In Yugoslavian)

The use of radioactive isotopes has provided a great stimulus for research in the field of experimental immunology. Radioactive tracer techniques have been employed in virtually all branches of immunological investigation. New possibilities of investigation offered by the use of radioactive isotopes on the fate of antigens *in vivo*: the properties, synthesis, and degradation of antibody molecule; and the use of labeled antibody in cancer research are reviewed. In all three of these areas much new knowledge has been gained through the use of tracer techniques.

329

A/CONF.15/P/2124  
MEKHAZIM ANTIBAKTERIAL'NOGO DEISTVIYA 6-AZURATSILA-4,5-C<sup>14</sup>. (Mechanism of the Antibacterial Action of 6-Azuracil-4,5-<sup>14</sup>C.) J. Škoda and F. Šorm (Czechoslovakia). 6p.

6-Azuracil-C<sup>14</sup> is converted into 6-azauracil riboside-C<sup>14</sup> by growing cultures of *E. coli*; this microbiological reaction was used to prepare relatively large amounts of the carcinostatic 6-azauracil riboside. The formation of 6-azauracil riboside is accompanied by an accumulation in the medium of orotic acid, free uracil, and hypoxanthine. 6-Azuracil is not metabolized in a cell-free extract of *E. coli* even in the presence of adenosine triphosphate and ribose-5-phosphate. However, the same cell-free extract gives rise to considerable amounts of radioactive nucleotide from 6-azauracil riboside-C<sup>14</sup> and adenosine triphosphate. The presence of uracil riboside inhibits the formation of 6-azauracil riboside-5'-phosphate. In the absence of adenosine triphosphate not even trace amounts of 6-azauracil riboside-5'-phosphate are formed.

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IN VIVO LOCALIZATION STUDIES OF IODINE-131-LABELED ANTI-MURPHY-STURM LYMPHOSARCOMA ANTIBODIES. Irving L. Spar, William F. Bale, and Ruth L. Goodland. (Univ. of Rochester, Rochester, N. Y.). *U. S. At. Energy Comm. UR-525*, 23(1958). CA-53:4508e.

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IN VITRO PRODUCTION OF DIPHTHERIA ANTITOXIN BY TISSUES OF IMMUNIZED ANIMALS. II. DEVELOPMENT OF A SYNTHETIC MEDIUM WHICH PROMOTES ANTIBODY SYNTHESIS AND THE INCORPORATION OF RADIOACTIVE AMINO ACIDS INTO ANTIBODY. Benjamin Wolf and Abram B. Stavitsky. (Western Reserve Univ., Cleveland, O.). *J. Immunol.* 81, 404-13(1958). CA-53:3445c.

## MICROBIOLOGY

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STUDIES OF PHOSPHOPROTEIN FUNCTIONS. II. THE EFFECT OF SOME GLYCOLYTIC INHIBITORS ON THE INCORPORATION RATE OF PHOSPHORUS-32 INTO TRICHLOROACETIC ACID-SOLUBLE NUCLEOTIDES AND PROTEIN PHOSPHORYLSERINE OF BAKERS' YEAST. Gunnar Agren. (Univ. Uppsala, Swed.). *Acta Soc. Med. Upsaliensis* 63, 137-48(1958). CA-53:6306f.

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EFFECT OF SEASONS ON THE SENSITIVITY TO ANTIBIOTICS OF THE INTESTINAL MICROFLORA IN THE DOG UNDER CHRONIC INFLUENCE OF STRONTIUM-90. O. G. Alekseeva and G. M. L'vitsina. *Med. Radiol. (Moskva)* 7, 58-61 (1962) Mar.

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A RAPID ASSAY METHOD FOR TRITIUM IN BACTERIAL CELLS. E. L. Alpen and H. G. Mandel. *Biochim. Biophys. Acta* 43, 317-21(1960) Sept.

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THE INFLUENCE OF POTASSIUM AND SODIUM ON THE METABOLISM OF METHIONINE IN YEASTS (INVESTIGATED WITH S<sup>35</sup>). F. Alten and O. Werk (Landwirtschaftliche Forschungsanstalt Bünthof, Hanover). 5p.

The influence of potassium and sodium on the metabolism of methionine in yeast was studied. Sulfur-35 was added to suspensions of potassium-exhausted yeasts. The effects of sodium and potassium on the uptake of sulfur and the formation of methionine were measured. Data are tabulated and discussed.

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IN VIVO INVESTIGATION OF THE REMOVAL OF TRACE ELEMENTS FROM NUCLEIC ACIDS OF YEAST BY IONIZING RADIATION. Hans Altmann,

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Neutron activation analysis was used to measure the content of certain trace elements in yeast nucleic acids before and after exposure to various doses of  $\text{Co}^{60}$   $\gamma$  radiation ranging from 0 to 24,000 rads. Data are presented for Cu, Mn, Ni, and Zn. A decrease of the trace element content at doses above 8000 rads was observed. Possible reaction mechanisms involved are discussed.

**340** STUDIES ON THE RESISTANCE TO  $\gamma$ -IRRADIATION OF  $\text{Co}^{60}$  IN *ESCH. COLI* B. T. Aoyama (Kobe Medical Coll., Japan). *Nippon Igaku Hoshasen Gakkai Zasshi*. 20: 505-20(1960).

A strain of *Esch. coli* B, resistant to  $\text{Co}^{60}$   $\gamma$  irradiation, was isolated from the original strain by means of the training method. The resistance continued to be stable on subculture for 1.5 yr. This strain survived even after exposure to 115 and 200 r, which was three times the MLD of the original strain. Morphologically, the cell size of this strain was smaller than the original as observed microscopically and by electron microscope measurement. With regard to the fermentation of sugar and the other usual biological characteristics, no difference was detected between the resistant and the original strain. (Abstr. Japan Med. 1: No. 12, 1961).

**341** THE INACTIVATION OF *ESCHERICHIA COLI* BACTERIA LABELLED WITH TRITIATED THYMIDINE. Sonia Apelgot (Institut du Radium, Paris). p.167-78 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

Bacteria of the strain  $\text{B}_1^3 \text{thy}^-/\text{Sr}$ , which required thymine and are streptomycin-resistant, had their DNA labeled with tritiated thymidine. The radioactivity measurements were made with a liquid scintillation counting system, with two photomultipliers mounted in coincidence. Under these conditions, the efficiency of the measures was 4.5% and the background 130 counts/min. The radioactive bacteria were kept in sealed tubes either at  $0^\circ\text{C}$  or at  $-196^\circ\text{C}$  and their survival studied. These experiments showed that the radioactive bacteria are inactivated exponentially as a function of the number of tritium atoms disintegrated. The inactivation is temperature dependent. In both cases the killing efficiency per nuclear transmutation was determined and found as very low. The number of ion pairs generated by the  $\beta$  particles emitted as a consequence of the transmutation of  $\text{H}^3$  was evaluated and found quite comparable with the one found in the case of x rays. The suicide caused by the  $\text{H}^3$  disintegrations seems to be directly linked with the ionizations produced by the  $\beta$  particles inside the bacterial DNA.

**342** LABELLING OF A BACTERIAL DESOXYRIBONUCLEIC ACID BY RADIOPHOSPHORUS, RADIOCARBON AND TRITIUM: COMPARISON OF THE LETHAL EFFECTS. S. Apelgot and R. Latarjet. *Biochim. Biophys. Acta* 55, 40-55(1962) Jan. 22

**343** STUDIES AND EXPERIMENTS IN RADIOMICROBIOLOGY. ASSIMILATION OF  $\text{Fe}^{59}$ ,  $\text{I}^{131}$ ,  $\text{P}^{32}$ , AND  $\text{S}^{35}$  BY *STAPHYLOCOCCUS ENTEROTOXICUS*. C. Arghittu (C.A.M.E.N., Livorno, Italy). *Minerva Nucleare*, 4: 313-15(Nov. 1960). (In Italian)

The value of radioisotopic techniques in the field of microbiology was illustrated, and the technique was used to determine the radioactive uptake by *staphylococcus enterotoxicus* in the presence of  $\text{Fe}^{59}$ ,  $\text{I}^{131}$ ,  $\text{P}^{32}$ , and  $\text{S}^{35}$  was described. The uptakes of  $\text{I}^{131}$ ,  $\text{P}^{32}$ , and  $\text{S}^{35}$  by this organism were very low (1.8, 4.4, and 2.5%, respectively); whereas the uptake of  $\text{Fe}^{59}$  was considerable (31.8%). This finding is important as regards the choice of radioisotopes for labeling *staphylococcus enterotoxicus* and its toxin (enterotoxin).

**344** STUDIES AND EXPERIMENTS IN RADIOMICROBIOLOGY. II. DISTRIBUTION OF *STAPHYLOCOCCUS ENTEROTOXICUS* LABELED WITH  $\text{Fe}^{59}$  IN GUINEA PIGS INOCULATED BY INTRAPERITONEAL ROUTE AND CONCENTRATIONS OF THE RADIOELEMENTS IN THE GASTROENTERIC SYSTEM. C. Arghittu and B. D. Prandini. *Minerva Nucl.* 6, 58-62(1962) Feb.

**345** DISTRIBUTION OF MYCOBACTERIA TUBERCULOSIS LABELLED WITH RADIOACTIVE PHOSPHORUS IN THE BODY OF THE GUINEA PIG FOLLOWING INTRAVENOUS INOCULATION. O. P. Arkhipova and O. A. Uvarova. *Probl. Tuberk.* 40(2), 74-83(1962)

**346** DYNAMICS OF DISTRIBUTION OF  $\text{P}^{32}$  LABELED MYCOBACTERIA TUBERCULOSIS IN VACCINATED AND NON-VACCINATED GUINEA PIGS AFTER SUBCUTANEOUS INJECTION. O. P. Arkhipova and O. A. Uvarova. *Probl. Tuberk.* 38, (2), 53-65(1960)

**347** METABOLISM OF VIRUS-INFECTED TISSUES. II. EFFECT OF INFLUENZA VIRUS ON RIBONUCLEOTIDE METABOLISM IN CHICK CHORIOALLANTOIC MEMBRANES. Harold Arnoff and Max E. Rafelson, Jr. (Univ. of Illinois Coll. of Med., Chicago). *Arch. Biochem. Biophys.* 81, 421-9(1959). CA 53-14297a

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- 361** STUDIES ON THE INFLUENCE OF TRITIUM RADIATION ON ANAEROBIC BACTERIA FROM THE BOVINE RUMEN. J. Brueggemann and D. Giesecke (Universität, Munich). p.179-87 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)  
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EFFECTS OF DEUTERIUM OXIDE UPON POLIOVIRUS MULTIPLICATION. Richard I. Carp, David Kritchevsky, and Hilary Koprowski (Wistar Inst. of Anatomy and Biology, Philadelphia). Virology, **12**: 125-7(Sept. 1960).

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A/CONF.15/P/1386  
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Results are reported from a study of bacteriophage inactivation following assimilation of phosphorus-32. Data are included on inactivation due to external non-assimilated phosphorus-32, the inactivation of dry phage by assimilated phosphorus-32, and the effect of temperature and state of the medium on the inactivation of labeled bacteriophage.

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MECHANISM OF ANTIBIOTIC ACTION. XI. A NITROGEN-15-TRACER STUDY OF THE EFFECT OF CHLORAMPHENICOL ON THE NITROGEN METABOLISM OF *ESCHERICHIA COLI*. Jirina Cerna, Frantisek Sorm, and Vladimir Cermak. (Czech. Acad. Sci., Prague). Chem. listy **51**, 1932-8(1957). CA-52-2171e.

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For the study of the intracellular proteolytic system of the microorganism *Escherichia coli*, casein labeled with  $I^{131}$  and bacterial proteins from *E. coli* bio-synthetically labeled with  $S^{35}$  were used. Casein- $I^{131}$  proved to be most satisfactory especially because of the simplicity of the radioactivity measurements. The

sensitivity and exactness of the determination of the proteolytic activity by means of labeled substrates proved superior to the usual methods. The enzymatic activity in the extracts from bacterial homogenates was investigated. The hydrolysate of casein- $I^{131}$  was chromatographed. An undetermined spot not corresponding to either iodide, diiodo-, or moniodo-tyrosine was observed. This spot probably belongs to  $I^{131}$ -peptides. The proteolytic system splits casein as well as the bacterial proteins, the optimum pH being between 7.0 and 8.5. The activity of the proteolytic system is considerably decreased by p-chloromercuribenzoic acid, compounds forming metal complexes being ineffective. Hydrolysis of  $I^{131}$ -casein by freshly prepared extracts proceeds approximately linearly during the first two hours. The activity of extracts preincubated without substrate at +5°C or +25°C did not increase. This proves the absence of the zymogenic form of the corresponding enzyme in the cell. The presence of bacterial proteins in the extracts does not interfere with the determination of the proteolytic activity by means of labeled substrates.

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Potassium ions are actively transported into the cells when glucose in solution is fermented by yeast in the presence of potassium. A procedure is described for determining the concentration of the cation carrier in this reaction. Potassium ions labeled with potassium-32 were displaced from the carrier by means of excess rubidium, and the displaced potassium ions were measured by determining the radioactivity of the suspending fluid. The carrier system is considered to be a metal redox system, and the reaction mechanisms involved are discussed.
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UTILIZATION OF ACETATE-C<sup>14</sup> BY ESCHERICHIA COLI GROWN ON ACETATE AS THE SOLE CARBON SOURCE. Alvin J. Glasky and Max E. Rafelson, Jr. (Univ. of Illinois, Chicago). *J. Biol. Chem.* **234**, 2118-22(1959). *CA 53-20280i*

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MICROBIOLOGICAL FRACTIONATION OF THE HYDROGEN ISOTOPES. P. E. Gloud, Jr., Irving Friedman, and F. D. Sisler (U. S. Geological Survey, Washington) and V. H. Dibeler (National Bureau of Standards, Washington). *Science* **127**, 1394-5(1958) June 13.

As a part of a comprehensive plan of study of Bahamas sediments collected in May 1955, bacteriological analyses of the refrigerated samples were undertaken, beginning early in 1956. It was soon observed that a yet unidentified facultative aerobe found in teeming abundance in aragonite muds from a mid-bank locality west of Andros Island produced gas vigorously when it was cultured in a dextrose medium. It seemed likely that this gas was largely CO<sub>2</sub>, but a check-analysis was sought from the Mass Spectrometry Section of the National Bureau of Standards. That analysis showed 26.3% carbon dioxide and 63.4% hydrogen; the latter, within the resolving power of the apparatus, appeared to consist exclusively of common light hydrogen. The balance was 5.3% water vapor, 4.6% nitrogen, and 0.4% oxygen.

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FATE OF IODINE-131 LABELED ANTIGENS OF DYSENTERIAL BACILLI AFTER ORAL ADMINISTRATION IN ANIMALS. V. V. Grechko and T. S. Sedova. *Zh. Mikrobiol.* **31**, 117-22(1960) Nov.

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ON THE PREPARATION AND PROPERTIES OF I-131-LABELED ANTIGENS OF DYSENTERIAL BACTERIA. V. V. Grechko, T. S. Sedova. *Biokhimiia* **24**, 858-65(1959) Sept.-Oct.

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TRACER STUDIES OF FUNGICIDAL ACTION. Presented at Nuclear Engineering and Science Conference, held at Chicago, March 17 to 21, 1958. Preprint 71,

Session 1. R. W. Greenlee, H. T. Kemp, R. S. Davidson, and M. M. Baldwin (Battelle Memorial Inst., Columbus, Ohio). New York, American Institute of Chemical Engineers, 1958. 29p.

An attempt was made to correlate the sorption uptake of compounds of equal inherent toxicity with differential fungicidal effects. Two homologous series of compounds containing toxic moieties provided pairs which seemed suitable for a radiotracer sorption study of this relationship. The pairs chosen were potassium dimethyldithiocarbamate and potassium di-n-propyldithiocarbamate and N-n-butyl-ethylenethiourea and N-n-propyl-ethylenethiourea. The former member of each pair was decidedly more fungicidal than the latter. Chemical studies were made to demonstrate the chemical similarity and to find convenient preparative methods for these compounds. Radiosyntheses involved the incorporation of sulfur-35 in each case. In the case of the dithiocarbamate salts, the innocuous di-n-propyl derivative was more strongly sorbed than the toxic dimethyl compound. Similarly, with the N-alkylethylenethioureas, the less fungicidal n-propyl derivative was more strongly sorbed than the n-butyl compound. A possible explanation of the lack of toxic effect by the apparently inactive compounds is that, in these cases, the exercise of inherent toxicity is prevented by preferential sorption on the fungus spore wall.

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STUDIES IN THE BIOGENESIS OF MACROLIDES BY MEANS OF PROPIONIC ACID (1-C<sup>14</sup>-3-T). H. Grisebach, H. Achenbach, and W. Hofheinz (Universität, Freiburg i. B.). p.139-45 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The fundamental structure of the antibiotic erythromycin consists of a lactone ring in glucosidic connection to two sugars. The regular arrangement of C-methyl groups in erythromycin led Gerzon to believe that the biogenesis of the lactone ring is possibly brought about by seven units of propionate. For investigating this hypothesis, propionic acid, the methyl group of which was labeled with tritium whereas the carboxyl group was labeled with carbon-14 was synthesized. It is shown that, when this acid was added to *Streptomyces erythreus*, the C<sup>14</sup>/T ratio in erythromycin (measured with a gas counting tube) was reduced only by 14 to 25% as against the ratio of the propionic acid. When the sugars were split off the C<sup>14</sup>/T ratio remained constant. Decomposition of the lactone ring by Kuhn-Roth oxidation showed that more than 90% of the tritium was in the methyl groups and more than 90% of C<sup>14</sup> in those places, which had to be labeled if the propionic acid had been fitted in properly. The advantages of labeling the acid with tritium as well as with C<sup>14</sup> are also reflected by another concurrent experiment with propionic acid (3-T) and acetic acid, 1-C<sup>14</sup>. It could be concluded from the changes in the C<sup>14</sup>/T value that propionic acid is by far more readily taken up by erythromycin than acetic acid. These results and further experiments prove that the lactone ring of erythromycin is, indeed, made up of seven units of propionate. Similar experiments were carried out on the biogenesis of magnamycin.

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ROLE OF AMINO ACIDS IN NUCLEIC ACID SYNTHESIS IN ESCHERICHIA COLI. F. Gros and Françoise Gros-Doulcet (Inst. Pasteur, Paris). *Exptl. Cell Research* **14**, 104-31(1958) (in French). *CA 53-10367h*

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TRANSLOCATION OF COBALT-60 AND CESIUM-137 BY FUNGI IN AGAR AND SOIL CULTURES. E. Grossbard and D. R. Stranks. Nature (London) **184**, 310-4 (1959) Aug.

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COMPARATIVE FIXATION OF VARIOUS RADIOACTIVE PHOSPHOROUS SAMPLES BY BACTERIA. Antonina Guelin and Pierre Lepine (Institut Pasteur, Paris, France). Ann. inst. Pasteur, 101: 281-4 (Aug. 1961). (In French)

The fixation of  $P^{32}$  on killed bacteria varied greatly according to the sample used. The differences in the fixation seem to be independent of the specific radioactivity of the samples used and of their disintegration stage.

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DISTRIBUTION OF RADIOACTIVE PHOSPHORUS IN HEAT-KILLED BACTERIA. A. Guelin and P. Lepine. Ann. Inst. Pasteur (Par) **101**, 677-86 (1961) Nov.

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A/CONF.15/P/332  
SUR LA FIXATION DU RADIOPHOSPHORE MINERAL ( $P^{32}$ ) PAR DES CELLULES BACTERIENNES EN CROISSANCE. (Fixation of Mineral Radiophosphorus ( $P^{32}$ ) by Bacterial Cells in Growth.) A. Guelin and P. Lepine (Institut Pasteur, Paris). 8p.

Radiophosphorus is used in the study of the metabolic processes in bacteria and bacteriophagocytes. However, the phosphorus distribution and the conditions under which assimilation occurs are not well defined. An investigation was made with *Shigella paradysenteriae* Y6R on this problem. The results showed that  $P^{32}$  does not augment the multiplication of either the bacteria or the bacteriophage C16 associated with it. The phosphorus is retained in larger quantities by bacteria which are multiplying. The larger part of  $P^{32}$  retained appears to be attributable to adsorption on the bacterial surface rather than to assimilation.

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RADIOSENSITIVITY OF BACTERIA TO PHOSPHORUS  $P^{32}$  IN THE ABSENCE OF  $P^{31}$  IN THE MEDIUM. A. Guelin and P. Lepine. Ann. Inst. Pasteur (Paris) **104**, 450-9 (1963) Apr. (Fr)

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NITROGEN ASSIMILATION OF BREWERS' YEAST. Hans Guthenberg, Lennart Enebo, and Evald Sandegren. Svensk Bryggeritidskr. **69**, 81-8 (1954). CA-52: 10277g.

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DORMANCY OF BACTERIAL ENDOSPORES: REGULATION OF ELECTRON TRANSPORT BY DIPICOLONIC ACID. Harlyn O. Halvorson, Roy Doi, and Brooks D. Church (Univ. of Wisconsin, Madison). Proc. Natl. Acad. Sci. U.S. **44**, 1171-80 (1958). CA 53-12404a

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INTRACELLULAR PROTEIN AND NUCLEIC ACID TURNOVER IN RESTING YEAST CELLS. Harlyn O. Halvorson. (Univ. of Wisconsin, Madison). Biochim. et Biophys. Acta **27**, 255-66 (1958). (in English). CA-52: 8274b.

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ON THE SYNTHESIS OF PROTEIN AND POLYNUCLEO-

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EFFECTS OF  $P^{32}$  DECAY ON TRANSDUCTION BY *SALMONELLA* PHAGE P-22. P. E. Hartman and A. W. Kozinski. Virology **17**, 233-44 (1962) June

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NEW PEPTIDE-NUCLEOTIDE COMPOUNDS OBTAINED FROM *CHLORELLA* AND YEASTS. Eiji Hase, Sayoko Mihara, Hama Otsuka, and Hiroshi Tamiya (Univ. Tokyo). Biochim. et Biophys. Acta **32**, 298-300 (1959) (in English). CA 53-22242d

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CONVERSION OF D-GLUCOSE TO L-FUCOSE BY *AEROBACTER CLOACAE*. Edward C. Heath and Saul Roseman. (Univ. of Michigan, Ann Arbor). J. Biol. Chem. **230**, 511-19 (1958). CA-52: 9312h.

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DETERMINATION OF ANTIMICROBIAL ACTIVITY BY A RADIOISOTOPE METHOD. A. H. Heim, J. A. Curtin, and G. V. Levin. Antimicrob. Agents Ann., 123-8 (1960)

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EFFECTS OF MITOMYCIN AND ALPHA-RAYS ON THE CAPACITY OF *ESCHERICHIA COLI* B FOR PHAGE T3. F. Hercik. Folia Biol. (Praha) **9**, 42-50 (1963).

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THE ISOTOPE EFFECT IN THE FIXATION OF NITROGEN BY *AZOTOBACTER*. Thomas C. Hoering and Harrell T. Ford (Univ. of Arkansas, Fayetteville). J. Am. Chem. Soc. **82**, 376-8 (1960) Jan. 20.

The relative rates of fixation of  $N^{14}N^{14}$  and  $N^{15}N^{14}$  by *Azotobacter* were studied. The ratio of these rates is  $1.000 \pm 0.001$ . The isotope effect in a heterogeneous reaction, the catalytic hydrogenation of the double bond in azobenzene, was studied. No isotope effect was found. The rate-determining step in the mechanism of these reactions does not involve a change in bonding to nitrogen. The geochemical implications are discussed.

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ACCUMULATION OF FREELY EXTRACTABLE GLUTAMIC ACID BY LACTIC ACID BACTERIA. Joseph T. Holden and Jane Holman (City of Hope Med. Center, Duarte, Calif.). J. Biol. Chem. **234**, 865-71 (1959). CA 53-14229f

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THE HYDROXYLATION OF NICOTINIC ACID BY *PSEUDOMONAS FLUORESCENS*. A. L. Hunt, D. E. Hughes, and J. M. Lowenstein. (Univ. Oxford, Engl.). Biochem. J. **69**, 170-3 (1958). CA-52: 16468e.
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THE INFLUENCE OF CARBON-14-LABELLED DODECYLDIMETHYLBENZYLAMMONIUM BROMIDE ON *STAPHYLOCOCCUS AUREUS* AND *ESCHERICHIA COLI*. D. Jerchel and F. Hoffmeister. Radioisotopes Sci. Research, Proc. Intern. Conf. Paris, 1957, III, 15-23 (Pub. 1958)(in English). CA 53-19026g
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THE PREPARATION AND CHARACTERISTICS OF HIGHLY PURIFIED RADIOACTIVELY LABELLED POXVIRUS. W. K. Joklik (Australian National Univ., Canberra). Biochim. et Biophys. Acta, **61**: 290-301 (Aug. 20, 1962). (In English)  
Rabbitpox virus was grown in HeLa cells in medium containing  $P^{32}$  or L-[I- $C^{14}$ ] leucine. The virus was purified extensively and isolated as a discrete band in sucrose density gradients. Evidence is presented concerning the purity of such virus preparations. The  $P^{32}$ -containing virus was labelled principally in DNA (70% of the total radioactivity) and phospholipid (25%). In addition some label was liberated as inorganic phosphate following treatment with alkali. Evidence is presented which indicates that no RNA is present in the virus. The virus contains small amounts of inorganic phosphate and adsorbed RNA, DNA, and phospholipid which can be removed without lowering infectivity. Two examples are given illustrating problems which are greatly facilitated by the use of labelled virus. In the first it is shown that during the conversion of infectious to reactivable virus small amounts of protein are lost from the viral particles without exposure of DNA. In the second the effect of treatment with alkaline buffers (pH 11.4-12.0) was studied. The DNA of the virus becomes accessible to DNAase and in part diffuses out of the viral particle while only very little of the protein is solubilized. The significance of the observations is discussed.
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THE AMINO-ACID POOL AND CELLULAR LEAKAGE IN INTACT CELLS OF *RHIZOBIUM MELILOTI*. D. C. Jordan (Ontario Agr., Coll., Guelph). Can. J. Microbiol. **5**, 131-9(1959). CA 53-15203h
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DISSIMILATION OF C-14 LABELLED GLUCOSE BY *NEISSERIA MENINGITIDIS*. I. THE FORMATION OF  $CO_2$  AND ACETATE FROM GLUCOSE CARBON. K. Jyssum. Acta Path. Microbiol. Scand. **55**, 319-24(1962)
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EFFECT OF COBALT-60 GAMMA IRRADIATION ON VACCINIA VIRUSES AND ACCOMPANYING MICROFLORA. E. F. Kalinina, V. S. Galkina, A. Z. Adidov, and S. I. Nesmeianova. Med. Zh. Uzbek. **2**, 45-6(1962) Feb.
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EFFECT OF GAMMA RAYS OF Co-60 ON MICROBES CONTAMINATING SMALLPOX VACCINE (II). E. F. Kalinina and A. Z. Abidov. Med. Zh. Uzbek. **2**, 52-4(1963) Feb.
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EFFECT OF Co-60 GAMMA RAYS ON MICROBES CONTAMINATING SMALLPOX VACCINE. E. F. Kalinina, et al. Med. Zh. Uzbek. **6**, 62-3 (1963) June
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EFFECT OF ULTRAVIOLET RADIATION ON THE INCORPORATION OF RADIOACTIVE PHOSPHORUS IN GROWING AND NON-GROWING CELLS OF *VIBRIO CHOLERAE*. N. K. Kapoor, P. Sagar, and S. C. Agarwala (Central Drug Research Inst., Lucknow, India). J. Sci. Ind. Research (India), **21C**: 225-7(1962). (In English)

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The incorporation of  $P^{32}$  in *Vibrio* cells is stimulated by glucose and inhibited by chloromycetin, dinitrophenol, azide, and copper ions. In the trichloroacetic acid-insoluble fraction,  $P^{32}$  is shared mostly by phospholipids and nucleic acids. Larger doses of ultraviolet radiation are required to inhibit the  $P^{32}$  incorporation in the nongrowing cells. Incorporation of  $P^{32}$  in the growing cultures, however, is affected even at lower doses, and the effect is more pronounced in the DNA fraction. It was suggested that  $P^{32}$  incorporation may be through macromolecular turnover in the nongrowing cells, which appears to be relatively insensitive to ultraviolet irradiation as compared to the net synthesis in the growing cultures.

### 463 AEC-tr-4110

#### THE EFFECT OF THE DECAY OF RADIOACTIVE PHOSPHORUS ON MUTATION OF GENES WHEN INCORPORATED INTO THE CELLS OF *ESCHERICHIA COLI*.

(Mutagenes Wirking des Zerfalles von Radioaktivem Phosphor Nach Einbau in Zellen von *Escherichia Coli*). F. Kaudewitz, W. Vielmetter, and H. Friedrich-Freksa. Translated from *Z. Naturforsch.* 13b, 793-802(1958). 14p. JCL.

This paper was previously abstracted from the original language and appears in *NSA*, Vol. 13, as abstract No. 5265.

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#### MUTATING EFFECTS OF THE DECAY OF RADIOACTIVE PHOSPHORUS AFTER INCORPORATION IN CELLS OF *ESCHERICHIA COLI*. F. Kaudewitz, W. Vielmetter, and H. Friedrich-Freksa (Max-Planck-Institut für Virusforschung, Tübingen, Ger.). *Z. Naturforsch.* 13b, 793-802(1958) Dec. (In German)

Cells of *E. coli* labeled with  $P^{32}$  undergo inactivation during storage in liquid nitrogen ( $-196^{\circ}\text{C}$ ). Thawing the samples after storage and plating them immediately on complete medium yield colonies of uniform appearance. However, replica plating on minimal medium demonstrates that during  $P^{32}$  decay there occurred a significant increase in nutritionally deficient (auxotrophic) mutants. When  $10^{-4}$  is the survival rate, 0.67% of surviving cells give rise to auxotrophic colonies, 40 to 50% of which have prototrophic sectors. During storage the increase of mutants is linear with respect to inactivation of bacteria and to the fraction of  $P^{32}$  decayed. The experiments carried out show that inactivation and mutation are due to the decay of  $P^{32}$  atoms incorporated in cellular structures and not to effects of freezing, toxicity of contaminants present in the  $P^{32}$  solution, or ionization of  $\beta$  electrons. An increase of mutants by positive selection in the course of inactivation was excluded experimentally.

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GLUCOSE AND GLUCONATE DISSIMILATION IN *ACETOBACTER SUBOXIDANS*. Paul A. Kitos, Chih H. Wang, Bobby A. Mohler, Tsao E. King, and Vernon H. Cheldelin (Oregon State Coll., Corvallis). *J. Biol. Chem.* 233, 1295-8(1958). CA 53-8299c

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INCORPORATION OF PHOSPHORUS-32 IN CHORIOALLANTOIC CELLS AFTER INFECTION WITH INFLUENZA VIRUS IN VITRO. Olaf Klamerth. *Z. Naturforsch.* 14b, 78-81(1959). CA 53-15322i

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PYROPHOSPHATE FORMATION IN CELL-FREE EXTRACTS OF *ESCHERICHIA COLI*. Leiv Klungsöyr (Univ. Bergen, Norway). *Biochim. et Biophys. Acta* 34, 586-7 (1959) (in English). CA 53-22243e

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ISOTOPE STUDIES ON VIRUSES AND BACTERIOPHAGES. Gebhard Koch. p.349-66 of "Radioactive Isotopes in Physiology, Diagnostics, and Therapy. Volume II." Berlin, Springer-Verlag, 1961. (In English)

A review of isotopic studies on viruses and bacteriophages is introduced by a brief description of the (T2H-E. coli H) system and of the results obtained with it in order to illustrate the application of tracer techniques to problems of virus multiplication. Topics discussed include the composition of phage T<sub>2</sub> and the isolation of different phage components, the properties of phage components, functions of protein and DNA during viral growth, mortality of phage caused by decay of incorporated  $P^{32}$ , metabolism of phage-infected bacteria, transfer of parental viral material to progeny, and isotope studies with animal viruses.

### 469

ACETATE METABOLISM IN ACETATE-GROWN *PSEUDOMONAS*. FORMATION OF FOUR CARBON DICARBOXYLIC ACIDS FROM ACETATE BY *PSEUDOMONAS* KB1. H. L. Kornberg and N. B. Madsen. *Biochem. J.* 66, 13P-14P(1957). CA-53:6340f.

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GLYOXYLATE CYCLE IN *ASPERGILLUS NIGER*. H. L. Kornberg and J. F. Collins. (Univ. Oxford, Engl.). *Biochem. J.* 68, 3P-4P (1958). CA-53: 1455b.

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METABOLISM OF  $C_2$  COMPOUNDS IN MICROORGANISMS. I. THE INCORPORATION OF ACETATE-2- $C^{14}$  BY *PSEUDOMONAS FLUORESCENS*, AND BY A *CORYNEBACTERIUM*, GROWN ON AMMONIUM ACETATE. H. L. Kornberg. (Univ. Oxford, Engl.). *Biochem. J.* 68, 535-41(1958). CA-52: 12982h.

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METABOLISM OF  $C_2$  COMPOUNDS IN MICROORGANISMS. II. THE EFFECT OF CARBON DIOXIDE ON INCORPORATION OF ACETATE- $C^{14}$  BY ACETATE-GROWN *PSEUDOMONAS* KB1. H. L. Kornberg and J. R. Quayle. (Univ. Oxford, Engl.). *Biochem. J.* 68, 542-9(1958). CA-52: 12983b.

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ABSENCE OF PHOSPHOTRIESTER LINKAGE IN TOBACCO MOSAIC VIRUS. D. E. Koshland, Jr., Norman S. Simmons, and J. D. Watson. (Brookhaven Natl. Lab., Upton, N. Y.). *J. Am. Chem. Soc.* 80, 105-7(1958). CA-52: 7449e.

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the autotrophic sulfur bacteria *Th. thioparus* utilize  
only the sulfhydryl group of the thiosulfate molecule.  
When the -SH group of thiosulfate was labelled with  
 $S^{35}$ , the elementary sulfur and sulfate were radioactive.  
When the central sulfur atom of thiosulfate was  
labelled, no radioactivity was detectable in the free  
sulfur. In the present investigation it was found that  
hydrogen sulfide is oxidized to free sulfur and sulfate  
ion. The labelled cysteine and alanylthiosulfate also  
undergo oxidation; the cysteine is metabolized only in  
the presence of thiosulfate in the medium. Further  
studies were undertaken on the primary organic inter-  
mediate products containing radioactive sulfur from  
thiosulfate labelled in both positions. By means of  
various methods, especially paper chromatography,  
paper electrophoresis, and autoradiography it was  
possible to identify several organic sulfur-containing  
substances. From the appearance of these labelled  
intermediates the possible pathway of thiosulfate  
oxidation was inferred. The mode of utilization of  
energy from inorganic substances and its transforma-  
tion for the processes of life are suggested. The free  
amino-acid pool and the sequence of its synthesis with  
 $C^{14}$  were estimated, and further parts of the metabolic  
scheme for *Th. thioparus* are proposed.
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WITH  $C^{14}$ . W. Ostrowski (Academy of Medicine,  
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*thioparus* was found to synthesize vitamin  $B_{12}$  from in-  
organic salts in the presence of thiosulfate as a source  
of energy. Vitamin  $B_{12}$  was synthesized labeled with  
carbon-14 in every position, labeled with cobalt-60, and  
labeled simultaneously with carbon-14, cobalt-60, and  
phosphorus-32. Quantitative estimation of vitamin  $B_{12}$   
activity was made by microbiological tests with *Euglena*  
*gracilis* and *Ochromonas malhamensis*. All the prepa-  
rations of labeled vitamin  $B_{12}$  were used for investiga-  
tions on the metabolism of cyanocobalamin in animals.
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The effect of  $P^{32}$  on the phenotypic function of a gene was studied in differentially labeled *E. coli* zygotes.  $P^{32}$  decays outside of the gene governing  $\beta$ -galactosidase synthesis were able to prevent function of the gene; these decays did not irreversibly damage the gene itself. Position of the  $P^{32}$  in the zygote was all-important in determining the effectiveness of  $P^{32}$  decays, rather than simply the numbers of  $P^{32}$  atoms contained in the bacterial nucleic acid. Zygotes could be differentially labeled in such a way that  $P^{32}$  decays were effective only when they occurred in genetic material cis to the gene in question. The destructive effect of the  $P^{32}$  was restricted to the chromosome in which decay occurred and was not cytoplasmic in that it did not cause a loss of function of genes on other genetic segments. Decays in the  $F^-$  bacteria could be effective in halting expression of the injected gene for  $\beta$ -galactosidase when the zygotes were labeled completely in their  $F^-$  material.  $P^{32}$  decay is thought to cause phenotypic inactivation of a large segment of chromosome by a mechanism that does not involve intervention of cytoplasmic agents.

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Isotope techniques are particularly useful in the study of exchanges of cations across cell membranes. In the case of bivalent cations, useful isotopes are available for a number of physiologically important elements such as Ca, Sr, Mn, Zn, and Co, but not for Mg. Fortunately Mn and Mg behave similarly. Previous studies with bivalent cations indicate that two basic phenomena are involved; a reversible binding of the cations by anionic groups of the cell surface, and an essentially irreversible active-transport of the cations into the interior of the cell. The latter process requires energy derived from glycolysis, is related to the absorption of phosphate and potassium, and is relatively specific for Mg and Mn as compared with Ca and Sr. If the term "carrier" is applied to the membrane substances involved in the active transport process, then the evidence suggests that the "carrier" for Mg and Mn is a phosphorylated product formed from extracellular

phosphate. Thus, starved cells possess no capacity to transport the bivalent cations, nor does such a capacity appear during the active turnover of intracellular phosphate associated with metabolism. However, during the active transport of extracellular inorganic phosphate into the cell, the capacity to absorb Mg and Mn is acquired; a capacity which is retained for many hours in quiescent cells, but which disappears rather rapidly in glycolysing cells. The chemical nature of the cation-carrier is not specifically known. The conclusion that a phosphate compound is involved is based on the following facts: synthesis occurs only during phosphate absorption; breakdown is rapid during glycolysis; inhibition is observed with arsenate, a substance closely related to phosphate. The carrier is not identifiable with any of the known phosphate compounds of the cell. It is formed in small amounts from only a fraction of the absorbed phosphate, and therefore must function in a cyclic manner with a rapid turnover. The specificity pattern of the absorption process suggests that a protein is also involved. Both transport processes, that of phosphate and that of the bivalent cations, are membrane phenomena that are essentially irreversible, that is, no exchanges occur across the membrane. Both processes are coupled to a specific mode of metabolism, glycolysis, presumably at the glyceraldehyde-3-phosphate dehydrogenase reaction. The coupling is neither stoichiometric nor obligatory. The molecular mechanism is not known in either case, and further analysis of the situation is limited by lack of information concerning the intimate structure of the cell membrane

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ACCUMULATION OF RADIOACTIVE ISOTOPES OF STRONTIUM, RUTHENIUM, CESIUM, AND CERIUM BY SOME BACTERIA. T. V. Zharova (Academy of Sciences, Moscow). Mikrobiologiya, 30: 713-16(Mar.-Apr. 1962).

Results show that various radioactive elements are accumulated by bacteria in varying amounts. The value of the accumulation coefficients depends on the physical-chemical properties of the element, on the characteristics of the medium on which the bacteria are cultivated, and also probably on the physiological characteristics of the bacteria. Both in liquid medium and in the solid substrate, the bacteria maintain a definite selective relationship to the different radioactive isotopes. The accumulation coefficients of radioactive elements in bacteria in liquid medium considerably exceed those in solid media. Having the ability to accumulate radioactive isotopes in significant quantities, the bacteria can represent a danger in the transfer of radioactivity to the nutritive cycle, in which they are the first link. (Public Health Eng. Abstr., 42: No. 8, Aug. 1962)

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ACCUMULATION OF RADIOACTIVE ISOTOPES OF STRONTIUM, RUTHENIUM, CESIUM AND CERIUM BY SOME BACTERIA. T. V. Zharova. Mikrobiologiya 30, 871-6(1961) Sept.-Oct.

626

ACCUMULATION OF RADIOSTRONTIUM BY BACTERIAL CELLS. V. M. Zhogova. Gigiena i Sanit., No. 4: 5-9(1961).

Similar to other aquatic organisms, bacteria are capable of accumulating considerable amounts of strontium-90 from the water polluted with the isotope. In an hour the microbic cells become 10 to 100 times more radioactive than the surrounding medium, and, consequently, they are an important link in the food chains by means of which radioactive strontium may reach the body of men and animals from the polluted water basins. It was noted that the smaller concentration of bacterial suspension and the lower the specific activity of medium, the higher the coefficient of radio-strontium accumulation in bacterial cells. However, irrespective of the concentration of microbes, the bacterial suspension extracts from the liquid medium an average of 10% of strontium-90. Therefore bacterial and activated sludge may not be successfully used for the removal of this isotope from the radioactive wastes and effluents. The process of physico-chemical adsorption is most probably the basis of the strontium accumulation in bacterial cells. (Public Health Eng. Abstr., 41: No. 8, 1961)

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ACTION OF VARIOUS CONCENTRATIONS OF  $\alpha$ - AND  $\beta$ -RADIATORS ON SUSPENSIONS OF INTESTINAL BACTERIA IN PHYSIOLOGICAL SOLUTION. V. M. Zhogova. Gigiena i Sanit. 23, No. 12, 80(1958). CA 53-17383e

## NUTRITION

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EFFECT OF BONE ON STRONTIUM-89 AND CALCIUM-45 IN BEEF ROASTS. M. C. Bell and R. G. Buescher. J. Amer. Diet Ass. 39, 567-8 (1961) Dec.

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GAMMA-EMITTING NUCLIDES IN MILK SINCE 1960. R. E. Bentley. Nature (London) 196, 738-40(1962) Nov. 24

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TRACE-MINERAL DIETARY INTERRELATIONS. Geo. K. Davis. (Univ. of Florida, Gainesville). Borden's Rev. Nutrition Research 18, 83-93 (1957). CA-52: 7457h.

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RADIOACTIVITY IN THE DIET. G. M. Dunning. J. Amer. Diet Ass. 42, 17-28(1963) Jan.

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THE EFFECTS OF COBALT-60 RADIATION ON TRICHINELLA SPIRALIS IN MEAT. H. C. Gibbs, K. F. MacQueen and J. W. Pullin. Canad. J. Public Health 52, 232-40(1961) June.

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STRONTIUM-90 CONTENT OF DUTCH FOODSTUFFS. H. J. Hardon and J. W. Haken. Voeding 23, 330-7(1962) Mar. 15.

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TRANSFER OF SOME TRANSURANIC ELEMENTS TO MILK. R. O. McClellan, H. W. Casey, and L. K. Bustad. Health Phys. 8, 689-94 (1962) Dec.

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STUDY OF THE RESTORATION OF WATER IN SEVERELY UNDERNOURISHED CHILD (KWASHIORKOR) WITH TRITIATED WATER. C. Paque. Med. Monde 37, 15-9(1961)

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EFFECT OF METHIONINE AND OTHER NITROGEN SOURCES ON BIOCHEMICAL PROCESSES IN THE LIVER. L. Prosky and R. W. Wannemacher, Jr. J. Nutr. 78, 419-23(1962) Dec.

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CAESIUM-137 IN DRIED MILK PRODUCTS IN RELATION TO PHYTOCLIMATIC ZONES. W. H. Rickard, A. D. Wiggins, and J. K. Fremstad. Nature (London) 197, 197-8(1963) Jan. 12

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(AED-C-05-03) AUSGEWÄHLTES SCHRIFT-TUM NACH SACHGEBIETEN. STRAHLENKONSERVIERUNG UND KONTAMINATION VON LEBENSMITTELN. BIBLIOGRAPHISCHE ZUSAMMENSTELLUNG. (Selected Literature According to Subject Field. Radiation Preservation and Contamination of Food. Bibliographic Compilation). U. Schuetzsack, comp. (Gmelin-Institut für Anorganische Chemie und Grenzgebiete, Frankfurt am Main). Mar. 1963. 169p.

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RADIOACTIVE CONTAMINATION OF FOOD. L. R. Setter. *J. Amer. Diet. Assoc.* 39, 561-6 (1961) Dec.

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TOTAL BODY FAT DETERMINED BY POTASSIUM-40 CONTENT. *Nutr. Rev.* 19, 134-5 (1961) May

641

ZINC-65 AND ZIRCONIUM-95 IN FOOD. Marvin A. Van Dilla (Los Alamos Scientific Lab., N. Mex.). *Science* 131, 659-60 (1960) Mar. 4.

Zinc-65 has been found in small amounts in muscle and liver samples obtained from cattle raised in Nevada, and also in commercial hamburger and beef liver from the southwestern area. Zirconium-95 and niobium-95 were found in the liver samples but not in the muscle or hamburger. A trace of zinc-65 was detected in milk but none in people.

642

WOULD CALCIUM FROM BONE MEAL BE BETTER UTILIZED THAN FROM APATITE? STUDIES ON THE RESORPTION OF CALCIUM-45 FROM APATITE OR BONE-MEAL IN MAN. E. M. Warkalla and K. Schreier. *Muenchen Med. Wschr.* 102, 2150-2 (1960) Oct. 28

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EFFECT OF DIETARY CALCIUM AND PHOSPHORUS LEVELS ON BODY BURDENS OF INGESTED RADIO-STRONTIUM. R. H. Wasserman and C. L. Comar. *Proc. Soc. Exp. Biol. Med.* 103, 124-9 (1960) Jan.

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EFFECT OF DIETARY CALCIUM AND PHOSPHORUS LEVELS ON BODY BURDENS OF INGESTED RADIO-STRONTIUM. R. H. Wasserman and C. L. Comar (State Univ. Veterinary Coll., Ithaca, N. Y.). *Proc. Soc. Exptl. Biol. Med.* 103, 124-9 (1960) Jan.

It is emphasized that long term effects of dietary constituents on radiostrontium must be determined either by long term experiments or predicted from double tracer technics. Previous reports in disagreement as to the effect of increased dietary calcium on radiostrontium were reconciled by the following predictions: in immature rats, elevated dietary calcium levels (within physiological ranges) with or without increased phosphorus levels would almost proportionately reduce the body burden of dietary radiostrontium; in mature rats; elevated dietary calcium levels alone would not proportionately reduce the radiostrontium; and in mature rats, simultaneous increases in dietary calcium and phosphorus levels would to some degree reduce the ultimate body burden of radiostrontium.

645

EFFECTIVENESS OF DIETARY SUBSTANCES IN REDUCING THE RETENTION OF CHRONICALLY INGESTED RADIOSTRONTIUM: STUDIES WITH TANNIN. R. H. Wasserman and C. L. Comar (New York State Univ.,

Veterinary Coll., Ithaca). *Nature* 185, 629-30 (1960) Feb. 27.

Data are presented from a study on the influence of dietary tannin on the bone retention of continuously ingested calcium-45 and strontium-85.

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METABOLIC PATTERNS IN PREADOLESCENT CHILDREN. III. SULFUR BALANCE ON THREE LEVELS OF NITROGEN INTAKE. J. B. Wright, P. G. Martin, M. L. Skellenger, and D. S. Moschette. *J. Nutr.* 72, 314-6 (1960) Nov.

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BALANCE OF POTASSIUM, RUBIDIUM AND CAESIUM BETWEEN JAPANESE PEOPLE AND DIET AND ASSESSMENTS OF THEIR BIOLOGICAL HALF-TIMES. N. Yamagata. *Nature (London)* 196, 83-4 (1962) Oct. 6.

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IN VIVO MEASUREMENT OF IODINE-131 IN THE THYROID OF THE DAIRY COW AS AN AID FOR MONITORING MILK. N. Yamagata and K. Iwashima. *Nature (London)* 198, 169-70 (1963) Apr.

## PLANT PHYSIOLOGY

649 (CEA-1860) ABSORPTION DE RADIOELEMENTS DU SOL PAR DIVERS LEGUMES CULTIVES DANS LES CONDITIONS DE LA PRATIQUE. (Absorption of Radioelements from the Soil by Various Vegetables Grown Under Normal Condition of Cultivation). (France. Institut National de la Recherche Argonomique, Paris and France. Commissariat à l'Energie Atomique. Centre d'Etudes Nucléaires, Saclay). 1961. 31p.

Various vegetables were cultivated in 4 different types of soil, having received, or receiving periodically,  $\text{Sr}^{90}$  or  $\text{Cs}^{137}$  in fairly strong doses to facilitate the measurement of the fraction of these radioelements taken up by the vegetables. In sandy soil, whole plants absorbed 2 to 3% of Sr and 3 to 9 ppt of Cs approximately; in clay soils, 1 to 6 ppt of Sr and 0.2 to 2 ppt of Cs; Cs, however, migrated relatively more than Sr in fruits or storage organs. The experiments confirmed that the quotient of the ratios  $\text{Sr}^{90}/\text{Ca}$  in the vegetables and in the plowed layer varies comparatively slightly; there would be a certain safety margin in assuming this ratio to be slightly above unity (to be confirmed after homogenizing the plowed layer). In view of the fact that in an arid climate it is necessary to apply several tens of liters of irrigation water (up to 50) in order to produce 1 kg of vegetables (fresh whole plants) and that furthermore, the radioelements of the residue from the crop harvest return to the soil, it can be expected that the limit of accumulation 1 kg of certain vegetables will contain as much of each radioelement as several tens of liters of irrigation water.

650

M-7107

Department of Agriculture. Soil and Water Conservation Research Div., Beltsville, Md.

ACCUMULATION AND MOVEMENT OF FISSION PRODUCTS IN SOILS AND PLANTS. Quarterly Report for Period July-September 1957. Oct. 1957. 8p. \$1.80(ph), \$1.80(mf) OTS.

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Progress is reported in a laboratory investigation of the fixation of strontium-90 by various soil types, a study of the movement of cesium-134 in different soil types, and an experiment to determine the distribution factors for strontium and calcium in alfalfa and wheat plants.

### 651 ORO-169

Tennessee. Univ., Knoxville.  
AGRICULTURAL RESEARCH PROGRAM. Semi-Annual Progress Report for January 1, 1957 to June 30, 1957. 54p. Contract AT-40-1-GEN-242. \$1.50(OTS).

Seventy-eight samples were irradiated at the plant and seed irradiation facility, including 67 seed samples; budwood of peach, chestnut, and grape; johnsongrass rhizomes; and sweetpotato roots. Pre-packaged irradiated barley seed and a mimeographed information letter, were prepared for distribution to high school science classes. The program is included for a symposium on Radiation in Plant Breeding held at Oak Ridge in January, 1958. Data are included from the following studies: factors controlling the metabolism of cesium and strontium in both plants and animals; the metabolism of calcium and strontium in rats; factors affecting the metabolism of calcium and phosphorus in lambs; radiation effects on reproductive physiology in cattle and rats; the relationship of survival time and whole-body gamma radiation dosage in swine, burros, and cattle; and a comparison of radium and strontium-90 toxicity in sheep. A list of publications during the period is included. (For preceding period see ORO-163.)

### 652 A/CONF.15/P/2312

THE EFFECT OF RHIZOSPHERE MICROORGANISMS UPON THE UPTAKE AND RELEASE OF PHOSPHORUS AND SULPHUR BY THE ROOTS OF ARBOREAL SEEDLINGS. A. I. Akhromeiko and V. A. Shestakova (U.S.S.R.). 20p.

Phosphorus-32 was used in tracer studies of the relationship between rhizosphere microorganisms and higher plants. Vigorous development of microorganisms within the rhizosphere was found to inhibit temporarily phosphorus entry into oak and ash tree seedlings, but an appreciable portion of the phosphorus taken up by the microorganisms became available for the plants after 10 days. Rhizosphere microorganisms were found to take up phosphorus compounds secreted by the seedling roots, thereby stimulating secretion of new portions of these compounds into the sand and water medium. A diurnal rhythm was noted both in the rate of root secretion of phosphorus and sulfur and in bacterial growth. Phosphorus containing root secretions also stimulated the growth of *Azotobacter* cells in the root system.

### 653

THE USE OF NITROGEN  $N^{15}$  IN STUDY OF THE PRODUCTS OF PHOTOSYNTHESIS. T. F. Andreeva (Inst. for Plant Physiology, Academy of Sciences, USSR). Kernenergie 3, 859-62(1960) Sept. (In German)

The synthesis of amino acids and proteins from inorganic nitrogen during photosynthesis is studied using nitrogen labeled with  $N^{15}$ . It is shown that the acceleration of forming amino acids and proteins by irradiation is caused by the fact that these compounds are directly formed during photosynthesis. In leaves free from chlorophyll, however, irradiation only accelerates the entrance of inorganic nitrogen into the plant. The influence of irradiation on the

velocity of forming proteins depends on the physiological state of the plant.

### 654 TID-6594

Inter-American Inst. of Agricultural Sciences. Turrialba, Costa Rica.

THE APPLICATION OF NUCLEAR ENERGY TO AGRICULTURE. Quarterly Report. July 1, 1960. 47p. Contract AT(30-1)-2043. OTS.

Preliminary results are reported from studies on the effect of pH on the foliar absorption and translocation of  $P^{32}$  applied to the leaves of coffee plants; tracer studies on the extractable phosphates from fertilizers in tropical soils; the effects of radiation exposure on flushing of rubber trees and CACAO plants and the growth of palm trees; the radiosensitivity of grasses and cotton plants; the induction of mutants following the x-ray and neutron bombardment of coffee seeds; and the induction of rice mutants following  $\gamma$  irradiation of seeds.

### 655

NON-EXCHANGEABILITY OF  $^{28}\text{Mg}$  WITH CHLOROPHYLL a. S. Aronoff (Univ. of California, Berkeley). Biochim. et Biophys. Acta, 60: 193-5(June 18, 1962). (In English)

Results of studies on *Chlorella*, grown in a mg-reduced medium supplemented with carrier-free  $\text{Mg}^{28}$ , showed that  $\text{Mg}^{28}$  does not exchange in aqueous acetone with the Mg of chlorophyll a. A practical consequence of this absence of exchange is that the absolute kinetics of chlorophyll biogenesis or turnover may be studied without the concern of exchange with preformed chlorophyll.

### 656

A/CONF.15/P/401

Oak Ridge National Lab., Tenn.  
STRONTIUM-90 AND CESIUM-137 UPTAKE BY VEGETATION UNDER NATURAL CONDITIONS. S. I. Auerbach and D. A. Crossley, Jr. 14p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy. 1958.

The strontium-90 and cesium-137 movement from soil to man is one of the complex problems arising from reactor operations. Most of the information on the plant to soil relationships of these two fission products has been obtained from laboratory experiments utilizing nutrient solutions, prepared soils, and soils contaminated by weapons fallout. Little work has been done on these relationships with plants grown under field conditions. Long-term studies on permanent areas contaminated with these radionuclides have not been reported.

Oak Ridge National Laboratory has an area which is uniquely suited for long-term studies under field conditions. This area was formerly a 40-acre radioactive waste impoundment (White Oak Lake) which for 12 years received a continuous input of low-level radioactive wastes. Two years ago the basin was drained, leaving about 35 acres of contaminated terrain. The resulting soil in this area can be characterized as a relatively unconsolidated alluvial sediment, heterogeneous in composition, calcareous, somewhat saline, and alkaline in reaction. Concentrations of strontium-90 and cesium-137 in the first six inches range from 0.02 to 0.29 and from 0.5 to 2.0 microcuries per 100 grams of soil, respectively. Significant concentrations of cobalt-60, ruthenium-106, cerium-144, and the trivalent rare earths are present also. The  $\mu\text{mcSr-90}$  to 1 gram  $\text{Ca}^+$  and the  $\mu\text{mcCs-137}$  to 1 gram K ratios in the leaves of one of the native plants (*Polygonum lapathifolium* L.) on



## REFERENCES

the lake bed ranged from  $5.64 \times 10^4$  to  $1.91 \times 10^5$  and from  $7.73 \times 10^4$  to  $1.67 \times 10^5$ , respectively. As a part of the investigations of uptake by vegetation, four common varieties of corn (*Zea mays*), namely, Hickory Cane, Aristogold Hybrid, Golden Bantam, and Country Gentleman, were planted in a part of the lake bed laid out in a latin square. Chemical and radiochemical (particularly strontium-90) analyses for the corn plants and native vegetation have not yet been completed nor have the data as yet been given a thorough statistical analysis. However, the first results indicate that the concentrations of cesium-137 may differ between plant organs. The cesium-137 to potassium ratios in the leaves, husks, cobs, and grain have the following ranges: Leaves,  $2.93 \times 10^4$  to  $5.87 \times 10^4$ ; husks,  $2.18 \times 10^4$  to  $4.18 \times 10^4$ ; cobs,  $1.76 \times 10^4$  to  $2.0 \times 10^4$ ; grain  $1.54 \times 10^4$  to  $1.84 \times 10^4$ . These data indicate a considerable discrimination against cesium-137 on the basis of 1 N ammonium acetate soil extractions of these cations. The strontium-90—calcium ratios obtained in this calcareous soil varied with the mode of extraction of these cations. The range of variation compares favorably with that reported by other workers.

### 657 A/CONF.15/P/291

EFFECT OF RADIATION ON SALT UPTAKE IN PLANTS. D. A. Barber (Agricultural Research Council, Grove, Wantage, Berks, Eng.) and G. J. Neary (Atomic Energy Research Establishment, Harwell, Berks, Eng.). 14p.

In plant nutritional experiments involving phosphate containing  $P^{32}$  as a radioactive tracer, there have been indications that the radiation emitted by the tracer may influence the uptake and distribution of salts. The radiation dose to the plant under such circumstances is, however, far from uniform and its estimation is uncertain. Experiments have therefore been carried out using precisely known doses from external sources of radiation. The uptake of Rb by suspensions of *Chlorella pyrenoidosa* from aerated 0.005 M solutions of RbCl containing tracer amounts of  $Rb^{86}$  was investigated at 30°C for periods of 1 hour. The Rb taken up was separated into fractions which exchanged readily with 0.01 M RbCl and which were non-exchangeable under the experimental conditions. This latter fraction would include ions that had undergone active transport. In no experiment was there any significant effect of radiation on the amount of the readily exchangeable ion fraction. During the period of Rb uptake 240-kv, x rays, and  $Co^{60}$   $\gamma$  rays significantly decreased the amount of non-exchangeable ion taken up. Over the range of 50 to 300 r there was an increased effect with increasing dose with little further increase in effect over the range of 300 to 1000 r. It appeared that the effect was proportionally greater when the natural rate of salt uptake was small. When x rays were delivered immediately prior to the period of Rb uptake there was a significant increase in the amount of non-exchangeable salt taken up as compared with the unirradiated controls. This effect appeared to be dose dependent and not influenced by dose-rate. The stimulatory effect of x rays delivered prior to Rb uptake was shown to exhibit an oxygen effect stimulation by a given dose being much reduced by irradiation under anaerobic conditions. In common with many physiological effects of radiation, the stimulatory effect of x rays appears to be connected with the oxidation of sulphydryl groups

since pretreatment with sulphydryl inhibitors had a similar effect and the presence of cysteine prevented the stimulation caused by both x rays and sulphydryl inhibitors.

### 658

COMPARATIVE RATES OF ENTRY OF PHOSPHORUS-32 AND CALCIUM-45 AND THEIR MOBILITIES IN A PLANT AFTER EXTRARADICAL NUTRITION. G. V. Barinov. *Doklady Akad. Nauk S.S.S.R.* 125, 227-8 (1959). CA 53-20302c

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PECULIARITIES OF UPTAKE OF SUBSTANCES THROUGH LEAVES IN FOLIAR NUTRITION OF PLANTS. G. V. Barinov and E. I. Ratner (K.A. Timiryazev Inst. Plant Physiol., Acad. Sci. U.S.S.R., Moscow). *Fiziol. Rasteniy, Akad. Nauk S.S.S.R.* 6, 324-32 (1959). CA 53-18198b

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THE EFFECTS OF HYDROXYLAMINE ON THE  $C^{14}O_2$  FIXATION PATTERN DURING PHOTOSYNTHESIS. J. A. Bassham, M. Kirk, and M. Calvin. (Univ. of California, Berkeley). *Proc. Natl. Acad. Sci. U.S.A.* 44, 491-3 (1958). CA-52:18697g.

### 661

RELATIONSHIP OF CERTAIN MACROSCOPIC MARINE ALGAE TO  $Zn^{65}$ . Paul Harry Bedrosian (Univ. of Florida, Gainesville). *Dissertation Abstr.*, 22: 3146 (Mar. 1962).

A study of the radioactive decontamination capacity of macroscopic algae was undertaken. Three algae, *Gracilaria foliifera*, *Enteromorpha prolifera* and *Sphacelaria* sp. were subjected to various controlled conditions of light and temperature in uptake experiments employing sea water dosed with  $Zn^{65}$ . Temperatures ranged from 5 to 25°C with light intensity varying from about 1 to 500 foot-candles. In separate investigations employing similar variations of light and temperature, non-radioactive growth rate determinations of *Enteromorpha* and *Sphacelaria* were made in order to associate the effect of such growth upon the uptake. To determine the retention capacity of algae, radioactive contaminated *Sphacelaria* samples were placed in two aquaria, one of which contained ordinary undosed sea water, while the other contained stable-zinc-enriched, undosed sea water. A translocation experiment and algal autoradiographs were used to aid in the general explanation of the uptake mechanism. The uptake experiments indicated that about 500 foot-candles of light and temperatures ranging between the approximate limits of 18 and 25°C were most conducive to maximum uptake. Of the factors contributing to the uptake, the more significant ones were perhaps the ratio of the algae's surface area to weight and the number of photosynthetic pigments in the algae. It was found that *Sphacelaria* in undosed sea water retained its  $Zn^{65}$  concentration approximately 0.7 day for the adsorbed portion and about 240 days for the absorbed portion—in undosed, zinc-saturated, sea water, the retentions were respectively 0.4 day and 240 days. Autoradiograph studies showed that *Gracilaria*'s uptake was primarily one of absorption rather than adsorption. *Enteromorpha*'s uptake was also primarily attributed to absorption. The autoradiographs indicated further that fast growing fruiting bodies concentrated  $Zn^{65}$  more rapidly than other parts of *Gracilaria*. No detectable translocation of  $Zn^{65}$  was noted with the equipment or method used. Approximate maximum concentration factors

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for the algae investigated ranged from 1,200 to 13,000. These factors were fairly independent of the concentration of  $Zn^{65}$  present in the sea water. Macroscopic marine algae reduce the concentration of radioactive substances in sea water. Efficiency of this reduction is influenced by the number of accessory pigments contained by the algae and also by the organisms' surface-area-to-weight ratio. Some algae can be stimulated by chemical means to achieve their maximum concentration of  $Zn^{65}$  in a shorter time than normally required. By the same means they can be forced to release their concentrated  $Zn^{65}$  more quickly.

### 662 A/CONF.15/P/843

California. Univ., Berkeley. Radiation Lab.  
EFFECT OF DEUTERIUM OXIDE (HEAVY WATER) ON BIOLOGICAL SYSTEMS. E. L. Bennett, M. Calvin, O. Holm-Hansen, A. M. Hughes, K. K. Lonberg-Holm, V. Moses, and B. M. Tolbert. 9p. (UCRL-3981). \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The effects of deuterium on growth, proton or deuterium uptake, and photosynthesis of algae are discussed. The effect of deuterium in prolonging the life of mice inoculated with tumors or leukemia, and the production of sterility in mice drinking  $D_2O$  are also discussed.

### 663 (TID-11114) INVESTIGATIONS OF PATHWAYS IN PLANT METABOLISM. Progress Report for the Period November 20, 1959–November 8, 1960. A. A. Benson (Pennsylvania State Univ., University Park). Nov. 5, 1960. 9p. Contract AT(30-1)-1876.

Neutron activation chromatographic analysis has been used widely for quantitative estimation of phosphatides in plant and animal tissues. Methods have been extended to include neutron activation of bromine-containing derivatives of organic compounds of metabolic significance. Sugars, carboxylic acids, and unsaturated fatty acids have been converted to derivatives containing bromine. Chromatography and neutron activation to give  $Br^{80}$  allows qualitative and quantitative analysis. The plant sulfolipid is recognized as a sulfolipid diglyceride. This chloroplast lipid, whose concentration approximates that of chlorophyll and exceeds that of most phosphatides, contains a sulfo-sugar. It is rapidly synthesized from either  $C^{14}O_2$  or from  $S^{35}O_4^{2-}$ . Further isolation of sulfolipid glycerol has been carried out and the sulfo-sugar has been isolated by anion exchange resin chromatography. The formation of the  $-CH_2-SO_3H$  structure constitutes an important aspect of carbohydrate metabolism in plants. The chemistry of aliphatic hydroxy sulfonic acids has received little attention. This study has been restricted by lack of fundamental chemical information. It has required synthesis of labeled sulfolipid aldehyde and sulfolipid aldehyde. It is apparent that these compounds are metabolized by plant cells. The physical and chemical properties of this family of compounds are being studied. Scintillation counting methods applicable in radiochromatographic studies were developed further. Plastic phosphors are used for counting  $C^{14}$  in chromatographic spots and in flowing effluents from exchange resin columns. The lipids of mitochondria were examined chromatographically. Plant mitochondria have phosphatidyl glycerol as the predominant lipid while chloroplasts contain much more of the galactosyl diglycerides. The characteristic lipid components of mitochondria were identified in pure monkey heart cell cultures.

### 664

PHOTOSYNTHESIS OF GALACTOLIPIDES. A. A. Benson, W. Wiser, R. A. Ferrari, and J. A. Miller. (Pennsylvania State Univ., University Park). *J. Am. Chem. Soc.* **80**, 4740(1958). CA-53:4442h.

### 665

RADIOCHEMICAL IDENTIFICATION OF DIGLYCEROPHOSPHATE AND ITS PROBABLE ROLE IN LIPIDE SYNTHESIS BY PLANTS. A. A. Benson and B. Maruo (Pennsylvania State Univ., University Park). *Radioisotopes Sci. Research, Proc. Intern. Conf., Paris, 1957*, **4**, 510-19(Pub. 1958). CA 53-20262i

### 666

EFFECT OF PREPLANTING IRRADIATION OF TUBERS WITH GAMMA RAYS OF Co-60 ON THE YIELD AND VITAMIN C CONTENT IN POTATOES. N. M. Berezina, G. I. Shchibria, V. V. Drozhzhina, R. R. Riza-Zade and A. D. Tarasova. *Radio-biologiya* **3**, 139-42(1963)

### 667

EFFECT OF POTASSIUM CYANIDE ON APPARENT FREE SPACE IN A BROWN ALGA. P. L. Bergquist. (Univ. Auckland, N. Z.). *Nature* **181**, 1270 (1958). CA-52: 20368b.

### 668

SELECTIVE DESTRUCTION BY HEAVY NUCLEAR IRRADIATION OF THE CELL MEMBRANE IN INTER-NODAL CELLS OF NITELLOPSIS OBTUSA. R. M. Bergstrom, R. F. Blafeld, and M. W. Brenner. *Ann. Med. Exp. Fenn.* **40**(Suppl.1), 1-44(1962)

### 669

THE ABSORPTION AND TRANSLOCATION OF  $P^{32}$  IN PLANTS OF PHASEOLUS VULGARIS IN THE PRESENCE OF POLYETHYLENE GLYCOL AND INDOLE ACETIC ACID. E. Betto, R. Foa, and A. Volpi (Univ. of Milan). pp. 249-56 in "Atti del Congresso Scientifico. Volume I. Sezione Nucleare, Giugno 1957." (In Italian)

A tracer study was made of the absorption and translocation of P in the presence of polyethylene glycol and indoleacetic acid. The results showed that the presence of glycol causes a better absorption and relative translocation of the phosphorus. The addition of indoleacetic acid causes no further increase in absorption or translocation. Separate studies confirmed that indoleacetic acid does not affect the absorption and translocation of phosphorus.

### 670

VARIATIONS IN THE ABSORPTION AND DISTRIBUTION OF PHOSPHORUS IN SINAPIS ALBA. STUDIED BY THE METHOD OF RADIOACTIVE PHOSPHORUS. I. VARIATIONS DURING PLANT DEVELOPMENT. G. Bfrnier. (Univ. Liege, Belg.). *Bull. soc. roy. sci. Liege* **26**, 341-53(1957). CA-52: 7436a.

### 671

CIRCULATION PATTERNS FOR PHOSPHORUS, SULFUR, AND CALCIUM IN THE BEAN PLANT. O. Biddulph, Susann Biddulph, R. Cory, and H. Koontz. (State Coll. of Washington, Pullman). *Plant Physiol.* **33**, 293-300(1958). CA-52: 20460a.

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PHOTOSYNTHESIS AND METABOLISM OF MARINE ALGAE. II. A SURVEY OF RATES AND PRODUCTS OF PHOTOSYNTHESIS IN  $C^{14}$ -CARBON DIOXIDE. R. G. S. Bidwell. (Atlantic Regional Lab., Halifax). *Can. J. Botany* **36**, 337-49(1958). CA-52: 12107b.

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PHOTOSYNTHESIS AND METABOLISM IN MARINE ALGAE. III. DISTRIBUTION OF PHOTOSYNTHETIC CARBON FROM  $C^{14}$ -CARBON DIOXIDE IN FUCUS VESICULOSUS. R. G. S. Bidwell, J. S. Craigie, and G. Krotkov. (Atlantic Regional Lab., Halifax). *Can. J. Botany* **36**, 581-90 (1958). CA-53:2381d.

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THE EFFECT OF IONIZING RAYS ON THE ENZYME ACTIVITY OF SUGAR BEET LEAVES. M. I. Bidzilya. *Dopovidi Ukr. Akad. Sil's'kogospodar'k Nauk* 1958, No. 4, 76-7; *Referat. Zhur. Khim., Biol. Khim.* 1959, Abstr. No. 3976. CA 53-15224b

675

THE EFFECT OF SULFUR-35 AND PHOSPHORUS-32 ON THE CHLOROPHYLL CONTENT OF PLANTS. M. I. Bidzilya. *Dopovidi Ukr. Akad. Sil's'kogospodars'k Nauk* 1958, No. 3, 7-10(Russian summary); *Referat. Zhur. Khim., Biol. Khim.* 1959, Abstr. No. 3975. CA 53-15224a

676

RADIATION SUCCULENCE. R. Biebl (Univ. of Vienna). *Atompraxis* **4**, 411-16(1958). (In German)

Chronic radiation with gamma rays of  $Co^{60}$  as well as single-dose x radiation in the first days of germination causes, from a certain dosage onwards, a succulence of the leaves in addition to various other morphological changes. The enlargement of the epidermis cells and decrease in the number of stomata per unit area connected with this, as well as the loosening of the leaf nervation, are characteristics which, from a purely morphological point of view, place "radiation succulence" closer to "salt succulence" than to "dry succulence." Possible connections are pointed out between the number of stomata and the increase in ascorbic-acid content in the leaves which were observed following radiation.

677

INCREASE OF  $C^{14}$  IN THE ATMOSPHERE FROM ARTIFICIAL SOURCES MEASURED IN A CALIFORNIA TREE. George S. Bien and H. E. Suess (Scripps Institution of Oceanography, La Jolla). *Z. Physik* **154**, 172-4(1959).

The increase in the  $C^{14}$  content of the atmosphere was determined by a measurement of the increased activity in a Ponderosa Pine in California. To avoid affects from diffusion of organic material within the tree, the lignite was separated from the rest of the wood components. The results, after correction for differences in  $C^{13}$  concentration, showed a  $10.49 \pm 0.2\%$  increase since 1953.

678

BIOCHEMICAL AND CHEMICAL STUDIES ON ASTRAGALUS LEAVES AND ROOTS. 1. ENZYMATIC; 2. TRANSLOCATION OF  $Se^{75}$  WITH RADIOAUTOGRAPHS; 3. ABSORPTION AND EXCHANGE OF  $Se^{75}$  IN ROOT

SEEDLINGS. Bulletin 385. (Wyoming. Agricultural Experiment Station, Laramie). 43p.

Studies on the enzymatic mechanism in respiration of the leaves of *Astragalus racemosus* suggest that the respiration is mediated by a cycle similar to, if not identical with, the Krebs citric acid cycle. Analysis of leaves, stems, and roots of *A. bisulcatus* grown in soil containing  $Se^{75}$  and  $K_2SeO_4$  indicated that not all parts of the plant contain the same amount of Se. The roots, as they absorb Se from the soil, do not store it but translocate it to the aerial parts of the plant. Radioautographs of the leaves indicated that there is a definite relation between metabolic activity and presence of Se in the plant. A method for the fractionation of leaf protoplasm and chloroplasts was developed for *A. bisulcatus*. Factors influencing the separation are discussed. The distribution of  $Se^{75}$  indicated that Se does not occur in firm combinations with the proteins of the chloroplasts. Most of the  $Se^{75}$  was present in the cytoplasmic fractions. Root seedlings of *A. preussii* contained a high concentration of Se and absorption of radioactive Se was mainly through active absorption and ionic exchange for the Se present in the roots. Live roots at 25°C attained ionic equilibrium at a rapid rate. At 0°C both live and dead roots failed to establish equilibrium between the roots and the exchange solution. Live root skeleton bound more than 10% of the  $Se^{75}$  which was not acid extractable. About 1% of the  $Se^{75}$  was bound in the dead root skeleton, and this was not removed during extraction.

679

UPTAKE AND METABOLISM OF AMINO ACIDS BY SLICES OF CARROT. L. M. Birt and F. J. R. Hurd. (Univ. Melbourne). *Biochem. J.* **70**, 277-86(1958). CA-53: 1470e.

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THIOCTIC ACID AND PHOTOSYNTHETIC FIXATION OF CARBON DIOXIDE. B. B. Biswas and S. P. Sen. (Bose Inst., Calcutta). *Nature* **181**, 1219-20(1958). CA-52: 16484c.

681

CARBON DIOXIDE UPTAKE STUDIES IN ALGAE GROWN IN WATER AND DEUTERIUM OXIDE. M. I. Blake, A. S. Kaganove, and J. J. Katz. *J. Pharm. Sci.* **51**, 375-9(1962) Apr.

682

THE USE OF RADIOACTIVE TRACERS IN THE DETERMINATION OF THE WATER OF HYDRATION OF NATIVE CELLULOSE BY THE RESIDUAL METHOD. Bertrand Bloch. *Compt. rend.* **247**, 1601-4(1958). CA 53-9654i

683

UCRL-3848  
California. Univ., Berkeley. Radiation Lab.  
PHOTOSYNTHESIS. Melvin Calvin. July 1957. 32p.  
Contract W-7405-eng-48. \$1.00(OTS).

The use of tracer carbon, as carbon-14, has made possible considerable progress in the mapping of the routes taken by the carbon atom from  $CO_2$  into plant substances. The techniques of separation and identification that have made this progress possible lie largely in the region of chromatography and radioautography involving fractional gamma amounts of material. Most of the earlier steps of carbon incorporation are now known and will be described. In addition, a number of the later steps on the routes to amino acids and proteins and other plant substances are now under investigation. As a result of the recognition of

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the earlier stages of carbon incorporation, a number of proposals have been postulated about the photochemical act itself. These proposals have led to the development of direct physical tests of their validity and some results of these will be described. The remaining principal area of investigation involving the route of oxygen atoms from water to molecular oxygen is largely unexplored, but the use of new methods of analyzing for the heavy isotopes of oxygen may make more progress in this area possible.

684 A/CONF.15/P/2246

California. Univ., Berkeley. Radiation Lab.  
PHOTOSYNTHESIS. Melvin Calvin, J. M. Anderson, James A. Bassham, U. Blass, O. Holm-Hansen, Vivian Moses, N. G. Pon, P. B. Sogo, and Gordon Tollin. 20p. \$0.50 (OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The oxygen pathway in photosynthesis was studied using  $O^{18}$  and an activation technique. High specific activity tritiated water was used to trace the path of hydrogen. These studies and carbon-14 studies of photosynthesis and electron spin resonance studies of primary quantum conversion in photosynthesis are summarized.

685

PHOSPHORUS ABSORPTION AND FIXATION IN VEGETABLES. IV. CONCOMITANT FIXATION OF PHOSPHORUS AND SULFUR IN VARIOUS PROTEIN FRACTIONS OF TISSUES IN RAPID GROWTH. Arturo Ceruti and Giuseppe Cetini. (Univ. Turin, Italy). *Atti accad. sci. Torino, Classe sci. fis. mat. e nat.* 91, 211-14(1956-57). CA-53: 2370e.

686

THE ABSORPTION AND TRANSPORT OF RADIO-ACTIVE CALCIUM,  $Ca^{45}$ , IN TOMATOES, A FIRST REPORT. Chin-Ching Chen and Yu-Yuen Yeh (National Taiwan Univ., Taiwan, [China]). Ho Tsu K'o Hsueh, 3: No. 2, 19-26(1961). (In Chinese)

The absorption and transport of calcium in tomatoes is studied hydroponically by using a Hoagland nutrient solution at half strength.  $Ca^{45}$  is used as the tracer. On account of the high temperature of the laboratory, transpirational loss of water is heavy, and the solution has to be checked every day and made up to strength. The "above ground" parts, particularly the leaves, are bathed with the same nutrient solution to see if absorption also takes place and, if absorbed, the direction of transport. The results indicate ready absorption of calcium by all parts of the plant but transport is essentially unidirectional.

687

THE GROWTH OF ALGAE IN  $D_2O$  DEUTERIUM OXIDE. William Chorney, Norbert J. Scully, Henry L. Crespi, and Joseph J. Katz (Argonne National Lab., Ill.). *Biochim. et Biophys. Acta*, 37: 280-7(Jan. 15, 1960). (In English)

The experiments described indicate that algae grow and divide in a medium containing more than 99%  $D_2O$ . After an inhibition period both *Chlorella* and *Scenedesmus* grew and divided, and after growth was established showed only a small percentage of abnormally large cells. The development of improved nutrient media for deuterated organisms is discussed. Deuterated compounds other than sugars were isolated from algae. It may be possible to use deuterated algae as such as a substrate for the growth of organisms

that would give high yields of specific compounds such as amino acids, nucleic acids, and antibiotics. Simultaneous labeling with  $C^{14}$  could also be accomplished. With the successful culture of algae in deuterated media the way is open for a considerable variety of experiments involving deuterium and its biological effects.

688 ACCUMULATION OF POTASSIUM, CESIUM<sup>137</sup>, AND RUBIDIUM<sup>86</sup> IN BEAN PLANTS GROWN IN NUTRIENT SOLUTIONS. J. F. Cline and F. P. Hungate (General Electric Co., Richland, Wash.). *Plant Physiol.* 35, 826-9 (1960) Nov. (HW-SA-1841).

By the addition of potassium to the nutrient substrate,  $Cs^{137}$  and  $Rb^{86}$  uptake by bean plants was reduced less than expected from an assumed physiological equivalence of these ions. Plants discriminated against cesium at low potassium nutrient concentrations; but with increasing substrate potassium, this discrimination diminished. Discrimination of  $Rb^{86}$  from potassium approximated that observed for  $Cs^{137}$ . Potential errors from the use of ratios in predicting uptake of  $Cs^{137}$  were discussed. Some toxicity was noted when significant quantities of nonradioactive cesium were in the nutrient solution.

689 EFFECT OF NUTRIENT POTASSIUM ON THE UPTAKE OF CAESIUM-137 AND POTASSIUM AND ON DISCRIMINATION FACTOR. J. F. Cline (General Electric Co., Richland, Wash.). *Nature*, 193: 1302-3(Mar. 31, 1962). (HW-SA-2360)

Five-day-old red kidney bean seedlings were grown for 16 days in solutions containing 0.02 to 30 mM K and 1  $\mu$ c/l  $Cs^{137}$ . At harvest, the roots, stems, and old and new leaves were analyzed for K and  $Cs^{137}$ . The results do not indicate either a constant  $Cs^{137}$  uptake or a constant discrimination factor ( $Cs^{137}/K$  ratio). Increase of the K level in the solution resulted in a fairly uniform increase in the K content of the plant tissues, but this increase was not proportional. The uptake of  $Cs^{137}$  was generally reduced by increased K, but the change was not uniform. The discrimination factor varied 6-fold in roots, 40-fold in stems, and 100-fold in leaves as solution K varied 2000-fold (0.02 to 30 mM). It is concluded that there is no valid reason for using ratios of K and  $Cs^{137}$  for food hazards evaluation.

690 (HW-72500(p.134-8)) EFFECT OF NUTRIENT POTASSIUM AND CESIUM ON UPTAKE OF CESIUM-137 BY PLANTS. J. F. Cline (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Accumulation of  $Cs^{137}$  was largely independent of potassium concentrations, indicating that discrimination by plants of these two elements changes. Cesium toxicity and factors affecting severity of toxicity are described. Visual toxicity was observed when potassium and cesium approached equal concentrations in the substrate.

691 HW-59500(p.87-9)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

EFFECT OF SOIL TYPE AND SOIL PLACEMENT OF  $Zn^{65}$  ON UPTAKE BY PLANTS. J. F. Cline. 3p.

Movement of  $Zn^{65}$  in calcareous soil was slight under all conditions tested.  $Zn^{65}$  stratified in this soil was nearly equally available to the plant at all positions tested. In acid soil movement of  $Zn^{65}$  was increased by presence of exchangeable ions in the eluting solution

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and stratification affected the amount of  $Zn^{65}$  taken up by plants.

**692** (HW-65500(p.34-6)) POTASSIUM, CESIUM-137, AND RUBIDIUM-86 RELATIONSHIPS IN PLANTS AND SOIL. J. F. Cline. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

Addition of potassium to the nutrient substrate reduced  $Cs^{137}$  and  $Rb^{86}$  uptake by plants, but less than expected from an assumed physiological equivalence of the ions. Discrimination between  $Cs^{137}$ -K or  $Rb^{86}$ -K varied with the concentration of potassium in the substrate. Cesium-137 was not moved appreciably through soil columns by water. Fifty per cent was leached from acid soil columns with 0.1 N KCl, but none was removed from alkaline soil. Flooding did not increase  $Cs^{137}$  uptake by rice plants over that observed when soil was not flooded.

**693** HW-62037  
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

POTASSIUM, CESIUM-137 AND RUBIDIUM-86 RELATIONSHIPS IN PLANT UPTAKE, SOIL DIFFUSION RATES AND IRRIGATION PRACTICES. J. F. Cline. May 24, 1960. 12p. Contract AT(45-1)-1350. OTS.

Addition of potassium to the nutrient substrate reduced  $Cs^{137}$  and  $Rb^{86}$  uptake by plants, but less than expected from an assumed physiological equivalence of the ions. Discrimination between  $Cs^{137}$ -K or  $Rb^{86}$ -K varied with the concentration of potassium in the substrate.  $Cs^{137}$  was not moved appreciably through soil columns by water. Fifty per cent was leached from acid soil columns with 0.1 N KCl, but none was removed from alkaline soil. Flooding did not increase  $Cs^{137}$  uptake by rice plants over that observed when soil was not flooded.

**694**  
EFFECT OF VARIOUS FORMS OF NITROGEN ON COMPOSITION OF LABELED PRODUCTS OF PHOTOSYNTHESIS IN CORN AND BEANS. N. G. Doman and S. G. Vakiinova. Doklady Akad. Nauk S.S.S.R. 122, 653-6(1958). CA-53:2373e.

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INTERRELATION BETWEEN PHOTOSYNTHESIS AND RESPIRATION IN PLANTS. N. G. Doman (Inst. Biochem., Acad. Sci. U.S.-S.R., Moscow). Biokhimiya 24, 19-24(1959). CA 53-11534b

**696**  
OXIDATIVE PHOSPHORYLATION OF MITOCHONDRIA OF PEAS STUDIED WITH PHOSPHORUS-32. G. Ducet. (Plant physiol. Sta., Versailles, France) and J. Rosenberg. Ann. inst. natl. recherche agron., Ser. A, Ann. agron., Ser. A, Ann. agron., Physiol. veg. 2, 23-33 (1958). CA-53:5429d.

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FATE OF ATOMS OF THE ARGININE MOLECULE IN THE COURSE OF ITS DEGRADATION BY JERUSALEM ARTICHOKE TISSUES. Henri Duranton. Compt. rend. 246, 3095-8(1958). CA-52: 20421e.

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FATE OF ATOMS OF AMIDINE GROUP OF ARGININE DURING DEGRADATION IN TISSUES OF JERUSALEM ARTICHOKE. Henri Duranton. Compt. rend. 247, 502-4(1958). CA-53:3398a.

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METABOLISM OF CHLOROPHYLL PIGMENTS IN TOBACCO. Jacques Duranton, Jean Michel Galmiche, and Eugene Roux. (Serv. biol., C.E.N., Saclay, France). Compt. rend 246, 992-5(1958). CA-52: 10299a.

**700**

INTRODUCTION OF RADIOACTIVE SOLUTIONS INTO TREES AND SHRUBS. R. P. Ealy. Oklahoma Agr. Expt. Sta. Tech. Publ. No. 70, (1957). 4p.

A technique is described for introducing radioactive solutions into the tap root of young trees and shrubs.

**701**

INCORPORATION OF CARBON-14 OR PHOSPHORUS-32 INTO THE PHOSPHATIDES OF RUNNER BEAN ~~XXXXXXXX~~ LEAVES. Frank M. Eberhardt and Morris Kates. (Natl. Research Labs., Ottawa). Can. J. Botany 35, 907-21(1957). CA-52-3051e.

**702**

EFFLUX AND RETENTION OF FOLIAR APPLIED PHOSPHORUS-32 AND SULFUR-35 BY INTACT BEAN ROOTS, AND THE INFLUENCE OF VARIOUS AMBIENT IONS ON THIS RELATIONSHIP. Fred H. Emmert (Univ. of Connecticut, Storrs). Plant and Soil, 14: No. 1, 33-42(Mar. 1961).

Tests were conducted to learn more about the quantitative aspects of efflux from intact plant roots and of possible influences of ion species in the recipient solutions on the process. Tests involved foliar introduction of  $P^{32}$  and  $S^{35}$  to bean plants and measurement of loss of isotope from roots to various single salt solutions. Comparisons were made of fraction lost as opposed to the fraction retained by the root. Both  $P^{32}$  and  $S^{35}$  were found to pass from bean root to surrounding solutions under all experimental conditions, however, less than 1% of what was in the root was lost. The process of exit of isotopes from roots was conditioned by composition of the surrounding medium. Data are tabulated.

**703**

EVIDENCE OF A BARRIER TO LATERAL PENETRATION OF P-32 ACROSS ROOTS OF INTACT TRANSPIRING PLANTS, BASED ON MEASUREMENTS OF XYLEM STREAM COMPOSITION. Fred H. Emmert (Univ. of Connecticut, Storrs). Physiol. Plantarum, 14: 478-87(1961). (In English)

Quantitative aspects of lateral penetration of  $P^{32}$  across roots of intact transpiring bean plants were investigated by measuring isotope which reached the xylem stream. Plants were grown to treatment size under controlled environment and nutrient conditions, and were then placed in a treatment solution containing  $P^{32}$ . Isotope which appeared in petiole, epicotyl, and hypocotyl samples over a 20 minute period was measured. Xylem stream  $P^{32}$  was at least partially separated from the metabolic fraction by subjecting only the sample to low temperature. Time course buildup of  $P^{32}$  in test samples following a distinct two-phase pattern. The first phase was an abrupt rise in sample activity 2 to 4 min following root introduction of isotope. This rise was not sensitive to sample temperature, and was attributed to initial passage of the isotope front through the samples. Buildup which occurred in the post 4 min period was in part sensitive to sample temperature. Reductions which occurred as a result of 3°C sample temperature were believed to represent isotope metabolically accumulated within the sample. Remaining activity was attributed to isotope in the xylem stream and

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to an unknown "X" fraction. Xylem volume of test samples was determined. Calculations were then made of activities which could be expected in the time course studies had composition of the ingoing stream not changed with respect to P-32. Results indicated that the bulk of P-32 was removed from the ingoing stream before reaching the test samples. The rapidity and efficiency with which the isotope was removed from the stream indicated that functional depletion was not the primary process involved. Suggestion was made of a specific barrier to transpiration passage of P<sup>32</sup> across the root.

**704** (TID-16380) EFFECT OF CHELATING AGENTS ON THE UPTAKE OF Y<sup>91</sup>, Rh<sup>106</sup>, Ce<sup>144</sup>, AND Pm<sup>147</sup> BY BEANS GROWN IN A CALCAREOUS SOIL. E. Essington, H. Nishita, and A. Wallace (California. Univ., Los Angeles. School of Medicine. Lab. of Nuclear Medicine and Radiation Biology). July 1962. Contract AT(04-1)-Gen-12. 28p.

The influence of cyclohexane-1,2-diaminetetraacetic acid (CDTA), diethylenetriaminepentaacetic acid (DTPA), and ethylenediamine di(o-hydroxyphenylacetic acid) (EDDHA) on the uptake of Y<sup>91</sup>, Ru<sup>106</sup>, Ce<sup>144</sup>, and Pm<sup>147</sup> by bean plants grown in a calcareous soil was studied. DTPA greatly increased the amount of Y<sup>91</sup>, Ce<sup>144</sup>, and Pm<sup>147</sup> accumulated in plant parts, especially the leaves. CDTA increased the Y<sup>91</sup> and Pm<sup>147</sup> uptake but the uptake of Ce<sup>144</sup> was affected only slightly. EDDHA slightly increased the Y<sup>91</sup> and Pm<sup>147</sup> accumulation in the leaves but did not affect that of Ce<sup>144</sup>. In general, the three chelates did not significantly affect the uptake of Ru<sup>106</sup> by plants. Application of chelating agents to the soil did not significantly change the dry weight yield of the plants. Paper chromatography of leaf extract indicated that Y<sup>91</sup>-DTPA complex was present in the leaves of bean plants grown in a soil treated with Y<sup>91</sup> and DTPA. This indicated that Y<sup>91</sup>-DTPA complex may have been translocated from the roots to the leaves.

**705** THE EFFECT OF METABOLISM ON THE TRANSPORT OF <sup>15</sup>O-LABELLED OXYGEN THROUGH *VICIA FABA* ROOTS. N. T. S. Evans and M. Ebert (Hammer-smith Hospital, London). Intern. J. Radiation Biol., 3: 627-36(Nov. 1961). (In English)

The transport of oxygen through continuous gas spaces in the root of the seedling of *Vicia faba* was investigated, using coincidence-counting of labelled nitrogen-oxygen gas mixtures containing 19% and 0.4% oxygen. The observations indicate that, in diffusing to the elongating zone and the radiosensitive root meristem, a little oxygen is lost to the tissue. This loss occurs in the region of the cotyledon and hypocotyl.

**706** RADIOISOTOPES IN SCIENTIFIC RESEARCH. VOLUME IV. RESEARCH WITH RADIOISOTOPES IN PLANT BIOLOGY AND SOME GENERAL PROBLEMS. Proceedings of the International Conference held in Paris in September 1957 under the Auspices of the United Nations Educational Scientific and Cultural Organization. R. C. Extermann, ed. New York, Pergamon Press, 1958. 708p.

Fifty-two papers are presented. Topics covered include applications of radioisotopes in studies on mineral metabolism in plants, translocation in plants, plant biosynthesis, and plant metabolism. Methods are discussed for measuring activity from carbon-14 used as a tracer. Results are included from tracer studies on the solu-

bility of calcium carbonate in ocean waters, the movement of radioactive phosphorus from the mud of lakes, and metabolism in zooplankton. A complete subject index is included.

**707** ABSORPTION, TRANSLOCATION, AND METABOLISM OF 2,4-D-1-C<sup>14</sup> IN PEA AND TOMATO PLANTS. S. C. Fang. (Oregon Agr. Expt. Sta., Corvallis). *Weeds* 6, 179-86(1958). CA-52: 20418f.

**708** M-7123  
Department of Agriculture.  
FIELD TRIAL OF TREATMENTS AFFECTING STRONTIUM UPTAKE. [1954]. 8p. \$1.80(ph), \$1.80(mf) OTS.

The uptake of strontium-89 by soybeans and blue-grass was measured following artificial contamination of the soil surface in a field experiment. The effects of various combinations of tillage treatments and additions of lime on this uptake were determined. The uptake of calcium by the crops was determined, and the ratios of strontium-89 to calcium were calculated for the soil and crops. Data are tabulated.

**709** NUCLEIC ACIDS IN SOME DEUTERATED GREEN ALGAE. E. Flaumenhaft, S. M. Conrad and J. J. Katz. *Science* 132, 892-4(1960) Sept. 30.

**710** RDB(W)/TN-187  
United Kingdom Atomic Energy Authority. Industrial Group. Windscale Works, Sellafield, Cumb., England. THE UPTAKE OF ZIRCONIUM<sup>95</sup> AND NIOBIUM<sup>95</sup> BY PORPHYRA SP. E. E. Foreman and W. L. Templeton. Feb. 1955. 15p.

Experiments carried out on the uptake of Zr<sup>95</sup> and Nb<sup>95</sup> by the edible seaweed, *Porphyra umbilicalis*, show that when the activity of the seawater is maintained at a constant level of  $8.65 \times 10^{-3}$   $\mu$ c/ml, concentration factors of 336 for zirconium and 435 for niobium are reached after 34 days. With the water activity constant at the lower level of  $9.5 \times 10^{-4}$   $\mu$ c/ml, the concentration factors for zirconium are 200 after 34 days and 230 after 73 days, and for niobium 420 after 34 days and 470 after 73 days. The release of zirconium and niobium was studied by placing drums of activated weed on the shore. Fifty per cent of the activity is lost after 6 days and 96 per cent after 65 days. The mode of uptake and methods of analysis are discussed.

**711** INCORPORATION OF CARBON-14-LABELED SUBSTRATES INTO THE AMINO ACIDS OF GROUNDNUT PLANTS (*ARACHIS HYPOGAEA*). L. Fowden and J. A. Webb. *Ann. Botany* 22, 73-93(1958). CA-52: 10294d.

**712** CAROTENOID BIOSYNTHESIS IN TOMATOES. F. J. Francis. (Univ. of Massachusetts, Amherst). *Proc. Am. Soc. Hort. Sci.* 71, 349-55(1958). CA-52: 18692i.

**713** DIRECT INCORPORATION OF MOLECULAR OXYGEN INTO ORGANIC MATERIAL BY RESPIRING CORN SEEDLINGS. G. J. Fritz, Wilmer G. Miller, R. H. Burris, and Laurens Anderson. (Pennsylvania State Univ., University Park).

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REDUCTION OF SULFATE TO SULFITE BY TOBACCO LEAVES. P. Fromageot and H. Perez-Milan (Serv. biol. comm. energie at., Gif-sur-Yvette, France). Biochim. et Biophys. Acta 32, 457-64(1959) (in French). CA 53-15228b
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CARBON METABOLISM IN THE HIGHER PLANTS. II. STRUCTURAL DISTRIBUTION OF THE CARBON-14 ABSORBED THROUGH THE LEAF IN THE RICE PLANT. Akio Fujiwara and Michio Suzuki. (Tohoku Univ., Sendai). Tohoku J. Agr. Research 8, 89-94(1957). CA-52: 20424a.
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PTERIDINES IN PHOTOSYNTHESIS. R. C. Fuller, I. C. Anderson, and H. A. Nathan. (Brookhaven Natl. Lab., Upton, N.Y.). Proc. Natl. Acad. Sci. U.S. 44, 239-44(1958). CA-52: 13887i.
- 717** TID-7554(p.475-86)  
Brookhaven National Lab., Upton, N. Y.  
USE OF ISOTOPES IN PLANT BIOCHEMISTRY. R. C. Fuller. p.475-86 [of] PROCEEDINGS OF THE INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NUCLEAR ENERGY, BROOKHAVEN NATIONAL LABORATORY, MAY 13-17, 1957. 12p.  
Applications of carbon-14 in studies of plant biochemistry are reviewed. The uses of oxygen-18, sulfur-35, and tritium in studies on photosynthesis and plant metabolism are discussed.
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DETERMINATION OF RADIOSTRONTIUM AND RADIOCESIUM IN THE SOIL AND PLANTS. P. Gaglione, A. Malvicini and Vidol. Minerva Nucl. 4, 155-61(1960) June
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RESPONSE OF THE YOUNG TOMATO PLANT TO A BRIEF PERIOD OF WATER SHORTAGE. IV. EFFECTS OF WATER STRESS ON THE RIBONUCLEIC ACID METABOLISM OF TOMATO LEAVES. C. T. Gates and James Bonner. (California Inst. of Technol., Pasadena). Plant Physiol. 34, 49-55(1959). CA-53:6363c.
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ASYMMETRIC DISTRIBUTION OF CARBON-14 IN SUGARS FORMED DURING PHOTOSYNTHESIS. Martin Gibbs and Otto Kandler. (Brookhaven Natl. Lab., Upton, N. Y.). Proc. Natl. Acad. Sci. U. S. 43, 446-51(1957). CA-52: 16490i.
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THE RELATION BETWEEN THE ABSORPTION SPECTRUM AND THE INTENSITY OF PHOTOSYNTHESIS IN THE RED ALGA RHODOSORUS MARINUS. Georges Giraud. Compt. rend. 248, 277-80(1959). CA 53-11525e
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REACTION OF TRANSFORMATION OF PROTOCHLOROPHYLL INTO CHLOROPHYLL. T. N. Godnev, A. A. Shlyk, and Ya. P. Lyakhnovich. (Biol. Inst., Minsk). Fiziol. Rastenii 4, 393-6(1957). CA-52-4755b.
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THE RaD CONTENT OF PLANTS OBTAINED BY A  $\gamma$  SPECTROSCOPIC METHOD. K. J. Godt and K. Sommermeyer (Universität Freiburg/Breisgau, Ger.). Atomkern-energie 5, 282-5(1960) July-Aug. (In German)  
The various kinds of radioactive compounds in plants are not only of interest from the science point of view but its knowledge is also required for critical judgment of questions regarding radiation protection. The RaD-content in plants, after all, is quite considerable as it can be measured by gamma-spectrographical methods, whereby the 46.5 kev-line can be regarded as proof.
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MODES OF ENTRY OF STRONTIUM INTO PLANT ROOTS. Juan de Dios Lopez Gonzalez and Hans Jenny (Universidad de Granada and Junta de Energia Nuclear, Spain and Univ. of California, Berkeley). Science 128, 90-1(1958) July 11.  
Data are summarized from a series of experiments on the modes of entry of strontium into plant roots. Strontium-85 was used as a tracer.
- 726**  
INCORPORATION OF C<sup>14</sup>-CARBON DIOXIDE, ACETATE-2-C<sup>14</sup> ACID INTO  $\beta$ -CAROTENE IN ETIOLATED MAIZE SEEDLINGS. T. W. Goodwin. (Univ. Liverpool, Engl.). Biochem. J. 69, 26P-27P (1958). CA-53: 502d.
- 727** A/CONF.15/P/1646  
CYTOCHEMICAL STUDIES OF NUCLEAR METABOLISM IN BIOLOGICAL SYSTEMS. A. R. Gopal-Ahengar (Atomic Energy Establishment. Trombay, India). 6p.  
With the aid of track autoradiography using an electron sensitive liquid emulsion it was possible to follow the intracellular incorporation of a labelled precursor like adenine-8-C<sup>14</sup> which is specific for nucleic acids. The incorporation was determined on the basis of the topographical emission of ionizing particles in particular organelles of the cell. The balance of evidence points to the fact that in oocytes of the newt. the nucleolus incorporates adenine with marked rapidity in the RNA. However, the fact that there is a high specific radioactivity in the nucleolus does not necessarily imply that the site of synthesis of RNA is centered in this intranuclear structure. since in the actively dividing meristematic cells of *Vicia faba* there is a preferential uptake of the labelled adenine in the heterochromatic and nucleolar organizing (SAT) regions of the long chromosomes. From this it would appear that the nucleolus acts as a reservoir of RNA and that actual synthesis supervenes in the heterochromatic regions and SAT-loci of particular chromosomes. In an attempt to understand the mechanics of chromosome replication, cytologists have made many assumptions. the validity of which has not been tested on cytochemical grounds until very recently. Although it has been known for long that during mitosis there is a doubling of chromosomes followed by an equipartition of chromosomal substance between the two daughter nuclei, no decisive technique has so far

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demonstrated whether the original chromosome produces by a self-duplicating process a replica of itself from available new material or whether the original chromosomal substance is equally distributed between the daughter nuclei. However, with the availability of specific precursors, like thymidine-2-C<sup>14</sup> of DNA and refinement in autoradiographic techniques it is now possible to selectively label particular components of chromosomes and follow the fate of the tagged atoms in successive mitotic cycles. In this way evidence is accumulating to suggest the operation of a template process in chromosome synthesis and duplication, at any rate in the somatic mitoses of *Vicia faba* and *Luzula* species. The cytological implications of such a synthesis are further discussed.

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CELLULOSE DEPOSITION OF ELONGATING EPIDERMAL CELLS OF AVENA COLEOPTILES. P. R. Gorham and J. R. Colvin. (Natl. Research Labs., Ottawa, Can.). Exptl. Cell Research **13**, 187-9(1957). CA-52: 16494e.

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EFFECTS OF BICARBONATE AND SOME OTHER ANIONS ON THE SHOOT CONTENT OF PHOSPHORUS-32, CALCIUM-45, IRON-59, RUBIDIUM-86, STRONTIUM-90, RUTHENIUM-106, CESIUM-137, AND CERIUM-144 IN BEAN AND BARLEY PLANTS. James A. Goss and E. M. Romney (Univ. of California, Los Angeles). Plant and Soil **10**, 233-41(1959). CA 53-15218b

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BIOSYNTHESIS OF GLYCOLATE AND RELATED COMPOUNDS FROM RIBOSE-1-C<sup>14</sup> IN TOBACCO LEAVES. Thomas Griffith and Richard U. Byerrum (Michigan State Univ., East Lansing). J. Biol. Chem. **234**, 762-4(1959). CA 53-13292i

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NP-tr-4  
SUPPLY OF RADIOACTIVE ISOTOPES TO THE PLANT BY WAY OF THE LEAVES. I. V. Gulyakin and E. V. Yudinseva. Translated by T. Turton from Doklady Akad. Nauk S.S.S.R. **111**, 709-12(1956). 8p.

**732**

A/CONF.15/P/2311  
UPTAKE OF STRONTIUM, CESIUM AND SOME OTHER FISSION PRODUCTS BY PLANTS AND THEIR ACCUMULATION IN CROP YIELD. I. V. Gulyakin and E. V. Yudinseva (U.S.S.R.). 25p.

The results of investigations conducted by the authors on the uptake of strontium-90, cesium-137, cerium-144, zirconium-95, ruthenium-106, and some other fission products by various agricultural plants summarized. Data on the distribution of the elements in plants and their accumulation in different parts of the crop plants as a function of biological characteristics of the plant environmental conditions are given. Possible agrochemical and agrotechnical aspects of the problem of controlling processes responsible for the amount of fission products accumulated and the ratio between strontium and calcium, and cesium and potassium in crop plants are considered. The results of the investigations show that the accumulation of radioactive fission products during the vegetative period increases with the growth of the above-ground mass of the plant. Reproductive organs of plant accumulate radioisotopes of

strontium and cesium in greater amount than other fission products. Data are tabulated.

**733**

A/CONF.15/P/2233  
RHYTHMICITY IN THE ABSORPTION AND ELIMINATION ACTIVITY OF THE ROOTS. I. I. Gunar, E. E. Krastina, and A. E. Petrov-Spiridonov (K. A. Timiriasev Agricultural Academy, Moscow). 41p.

Rhythmical alterations of physiological processes in the root systems of plants were established with the aid of tracer techniques employing phosphorus-32 labeled phosphates, sulfur-35 labeled sulfates, and potassium and calcium determined by polarographic methods. Factors influencing the rhythmic pattern are discussed.

**734**

ISOTOPE EXPERIMENTS ON THE 2,6-DICHLOROPHENOLINDOPHENOL-MEDIATED OXIDATION OF ASCORBIC ACID BY ILLUMINATED CHLOROPLASTS. Helen M. Habermann and Leo P. Vernon (Univ. of Chicago and Brigham Young Univ., Provo, Utah). Arch. Biochem. Biophys. **76**, 424-9(1958) Aug.

The use of oxygen isotopes revealed that when 2,6-dichlorophenolindophenol and ascorbic acid were added to a system containing illuminated *Phytolacca* chloroplasts functioning in a Mehler reaction, the rate of oxygen evolution was decreased to  $\frac{9}{10}$  while the rate of oxygen consumption was increased to  $2\frac{3}{4}$  times the original rates. After complete oxidation of the added ascorbate, the rate of oxygen evolution increased to  $1\frac{1}{2}$  times the original rate. These results support the assumption that ascorbate can be oxidized via the (OH) system produced by the photolysis of water.

**735**

A/CONF.15/P/1058  
Department of Agriculture. Mineral Nutrition Lab., Beltsville, Md.

THE FUNCTION OF OXIDATIVE METABOLISM IN THE PASSAGE OF IONS INTO PLANTS. Cal E. Hagen and Sterling B. Hendricks. 8p. \$0.50(OTS).

Prepared for the Second U. N. International Conference on the Peaceful Uses of Atomic Energy, 1958.

The cellular accumulation of phosphate as followed with phosphorus-32 tracer is shown to take place through sites coupled with oxidative phosphorylation in respiration.

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THE ROLE OF NITROGEN RESERVES IN NEW GROWTH OF APPLE AND THE TRANSPORT OF PHOSPHORUS-32 FROM ROOTS TO LEAVES DURING EARLY SPRING GROWTH. C. P. Harley, L. O. Regeimbal, and H. H. Moon (U.S. Dept. of Agr., Beltsville, Md.). Proc. Am. Soc. Hort. Sci. **72**, 57-63(1958). CA 53-9387h

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ABSORPTION OF RADIOACTIVE SULFUR BY THE FRUIT SYSTEM IN COMPARISON TO THE ROOTS OF PEANUTS. Henry C. Harris (Univ. of Florida, Gainesville). Proc. Intern. Conf. Peaceful Uses At. Energy, Geneva, 1955, **12**, 203-7(1956). CA 53-9383d

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PHYSIOLOGICAL STUDIES ON INEFFECTIVE TILLERS IN RICE, WHEAT, AND BARLEY PLANTS. I. EFFECT OF THE SMALL TILLERS ON THE RIPENING OF FRUITFUL STEMS IN WHEAT PLANTS. II. THE RELATION BETWEEN WEAK AND STRONG TILLERS AT THE STAGE OF VEGETATIVE GROWTH IN WHEAT



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LEAD-210 AND POLONIUM-210 IN GRASS. C. R. Hill (Royal Cancer Hospital, London). Nature 187, 211-12 (1960) July 16.  
Evidence is presented that suggests that a large part of the alpha activity observed in certain samples of grass may originate as a decay product of atmospheric radon which is deposited onto the grass by rainfall. Results are reported from measurements of alpha activity of samples of grass and soil collected in the southern part of Great Britain. Measurements were also made on tissues from lambs from the same region. Polonium-210 was found concentrated in the kidney. Observations of the decay of total alpha activity indicated that polonium-210 occurs in the absence of lead-210.
- 741**  
EFFECT OF HYDROGEN PEROXIDE ON THE LIGHT-INDUCED CAPACITY OF CARBON DIOXIDE-FIXATION IN GREEN ALGAE. Toyoyasu Hirokawa, Shigetoh Miyachi, and Hiroshi Tamiya (Tokugawa Inst. Biol. Research, Tokyo). J. Biochem. (Tokyo) 45, 1005-10(1958). CA 53-8308d
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EXPERIMENTAL DETERMINATION OF URANIUM IN LIVING FRESH-WATER ALGAE. (Experimentelle Erfassung von Uran in Lebenden Süsswasseralgen). Josef Hoffmann. Translated by W. H. Everhardy from Naturwissenschaften 29, 403-4(1941). 6p.
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RESPIRATION AND THE OXIDATIVE ACTIVITY OF PARTICULATE FRACTIONS FROM DEVELOPING PEPPER FRUITS (CAPSICUM ANNUUM). F. D. Howard and M. Yamaguchi. (Univ. of California, Davis). Plant Physiol. 32, 418-23(1957). CA-52-3938b.
- 744** (HW-63173) DECONTAMINATION OF PLANTS EXPOSED TO A SIMULATED REACTOR BURN. F. P. Hungate, J. D. Stewart, R. L. Uhler, and J. F. Cline. General Electric Co. Hanford Atomic Products Operation, Richland, Wash. July 1, 1960. 18p. Contract AT(45-1)-1350. OTS.  
A variety of plants was exposed to the products of a melted fuel element in a simulated reactor burn. Leaves were then washed in laboratory tests to determine percentage removal of  $I^{131}$ ,  $Ru^{103,106}$ , and  $Cs^{137}$ . From 60 to 90% of the  $I^{131}$  was removed. Distilled water was least effective and a household detergent was most effective as a decontaminating agent. By surface stripping, it was shown that less than 10% of the  $I^{131}$  was in the mesophyll tissue of leaves. Autoradiograms showed some distinct hot spots, presumed to be particulate, but also showed a diffuse deposit of activity on the leaves with a heavier concentration at the leaf margins. Since this marginal activity could be removed by plastic coatings, it was concluded to have resulted from dynamics of deposition rather than to transport within the leaf.
- 745** (HW-65500(p.85-90))  $I^{131}$  REMOVAL FROM LEAVES. F. P. Hungate, J. D. Stewart, R. L. Uhler, and J. F. Cline. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.  
The relative efficiencies of various agents in decontaminating leaves exposed to air-borne products from a melted fuel element are reported.
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SYNTHESIS OF PHLORIN AND OTHER PHENOLIC GLUCOSIDES BY PLANT TISSUES. A. Hutchinson, Chitra Roy, and G. H. N. Towers. (McGill Univ., Montreal, Can.). Nature 181, 841-2 (1958). CA-52: 13896g.
- 747** EVALUATION OF THE ORIGINS OF STRONTIUM-90 CONTAINED IN WHEAT PLANT. Ryushi Ichikawa, Michiko Abe, and Masako Eto (National Inst. of Radiological Sciences, Chiba City, Japan). Science, 133: 2017-8(June 23, 1961).  
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STRONTIUM-90 AND CESIUM-137 ABSORBED BY RICE PLANTS IN JAPAN, 1960. R. Ichikawa, M. Eto, and M. Abe. Science 135, 1072(1962) Mar.
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- 750** ISOTOPES IN SOIL-PLANT NUTRITION STUDIES. Intern. At. Energy Agency Bull., 4: No. 3, 10-13(July 1962).  
A summary is given of papers and discussions presented at the Symposium on Use of Radioisotopes in Soil-Plant Nutrition Studies in Bombay on Feb. 26 to March 2, 1962. Some of the topics discussed were soil chemistry, physical characteristics of soil, uptake and translocation of nutrients, measurement of available phosphorus, and fertilizer usage.
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AMINO ACIDS AND PROTEIN SYNTHESIS IN LEAVES OF THE BEAN PLANT. Shtefan Ivanko. Sbornik Stud. Nauch.-Issledovatel. Rabot Moskov. Sel'skokhoz. Akad. im. K. A. Timiryazeva 1958, No. 8, 171-8. CA-53: 1475g.
- 752** CAESIUM-137 LABELLED ALGAE FOR FILTRATION STUDIES. K. J. Ives (University Coll., London). Intern. J. Appl. Radiation and Isotopes, 9: 49-53(Dec. 1960). (In English)  
A method is described whereby the green algae *Chlorella* and *Scenedesmus* were cultured in a growth medium containing  $Cs^{137}$ . These radioactive algae were used as a suspension in water passing through a column of filter sand. The distributions of the algal cells retained in the filter

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were measured with a scintillation counter mounted externally to the column. Calibrations of the shielded scintillation counter for the amount of activity per algal cell and for the geometry of the filter column are described.

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INFLUENCE OF PHOTOSYNTHESIS OF INTRAMOLECULAR EXCHANGE PROCESSES OF HEXOSE. Otto Kandler and Martin Gibbs (Brookhaven Natl. Lab., Upton, N.Y.). Z. Naturforsch. 14b, 8-13(1959)(in German). CA 53-20282c

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OCCURRENCE OF AN UNKNOWN RADIOACTIVE SUBSTANCE AFTER SHORT-TIME PHOTOSYNTHESIS IN C<sup>14</sup>-CARBON DIOXIDE. O. Kandler. (Univ. of California, Berkeley). Arch. Biochem. Biophys. 73, 38-42(1958). CA-52: 8300d.

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RELATION BETWEEN INTENSITY OF PHOTOSYNTHESIS AND ENERGY OF RENEWAL OF CHLOROPHYLL. V. O. Kazaryan, G. G. Gabrielyan, and V. Sh. Agababyan. Doklady Akad. Nauk Armyan. S.S.R. 24, No. 5, 225-30(1957)(In Russian). CA-52-4755a.

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A MECHANISM FOR CYCLIC ENRICHMENT OF CARBON-12 BY TERRESTRIAL PLANTS. Charles D. Keeling (California Inst. of Tech., Pasadena). Geochim. et Cosmochim. Acta, 24: 299-313(July 1961). (In English)

A model is described which predicts that variations in the relative abundance of C<sup>12</sup> and C<sup>13</sup> in terrestrial plants may be due in part to varying degrees of local cycling of

carbon dioxide gas. The model emphasizes the effectiveness of transient departures from a steady state in achieving cyclic enrichment, and predicts that cyclic enrichment should be limited by the maximum concentration of carbon dioxide occurring near the plants during their diurnal cycle. Experimental data are discussed which support the model.

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RADIOCARBON IN CONTEMPORANEOUS PLANT PRODUCTS. V. N. Kerr, F. N. Hayes, E. Hansbury, and D. L. Williams. (Los Alamos Scientific Lab., N. Mex.) Oct. 27, 1961. (LAMS-2627(p.238-59))

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RADIOCARBON IN PLANT PRODUCTS: GEOGRAPHY, SPECIES, AND TIME. V. N. Kerr, D. L. Williams, E. Hansbury, and F. N. Hayes (Los Alamos Scientific Lab., N. Mex.). Z. Physik, 167: 273-83(1962). (In English)

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TRITIUM AND CARBON-14 IN THE TREE RINGS. Kunihiko Kigoshi and Yoshio Tomikura (Gakushuin Univ., Tokyo). Bull. Chem. Soc. Japan, 34: 1738-9(Nov. 1961). (In English)

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BIOLOGICAL EFFECTIVENESS OF C<sup>14</sup> WHEN INCORPORATED IN LIVING STRUCTURES. A. M. Kuzin, B. M. Isaev, V. V. Khvostova, V. I. Tokarskaya, and Yu. I. Bregadze (Inst. of Biological Physics, Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.* 134, 951-4 (1960) Oct. 1. (In Russian)  
Biological effects of C<sup>14</sup> incorporated into the cell structure were quantitatively correlated to the effects of Co<sup>60</sup>  $\gamma$  radiation in 10-day *vicia faba* plants. The percentage of cells with chromosome aberrations was used as the criterion of biological effects. The data show 9 to 25 fold stronger mutation effects from C<sup>14</sup> at identical absorbed energies. It is postulated that a considerable fraction of the mutations results from transformation effects, i.e., by C<sup>14</sup>  $\rightarrow$  N<sup>14</sup> and by the special geometry of radioactive carbon incorporation.
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(AEC-tr-4531) EFFECTIVENESS OF THE BIOLOGICAL ACTION OF C<sup>14</sup> WHEN INCLUDED IN LIVING STRUCTURES. A. M. Kuzin, B. M. Isaev (Isayev), V. V. Khvostova, V. I. Tokarskaya, and Yu. I. Bregadze (Akademiya Nauk S.S.S.R.). 1960. Translation of United Nations Report A/AC.82/G/L.423. 9p.  
The biological effects of a two or three day exposure to beta particles from C<sup>14</sup> were compared with the effects of a similar radiation dose from external Co<sup>60</sup> gamma radiation. The percentage of cells of *Vicia faba* with chromosome aberrations at the growth points of the stem following exposure was used as a criterion for biological action. Data are tabulated. Analysis of results shows that the mutagenic effect of C<sup>14</sup> introduced into the cells is 9 to 15 times greater than the effect of equal absorbed doses of outside gamma radiation. It is assumed that a significant part of the mutagenic effect of C<sup>14</sup> depends on the conversion of C<sup>14</sup> to N<sup>14</sup>. The possible influence of radioactive carbon from the explosion of megaton hydrogen bombs on living organisms is discussed briefly.
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DISTRIBUTION STUDIES OF RADIOACTIVE FLUORINE-18 AND STABLE FLUORINE-19 IN TOMATO PLANTS. Myron C. Ledbetter, Radu Mavrodineanu, and Allen J. Weiss (Brookhaven National Lab.). Contribs. Boyce Thompson Inst. 20, 331-48(1960) Jan.-Mar. (BNL-4721)

A study of distribution and site of accumulation of fluorine in tomato plants was carried out using  $\text{NaF}^{18}$ ,  $\text{HF}^{18}$ ,  $\text{NaF}^{19}$ , and  $\text{HF}^{19}$  applied as solutions through roots and cut vascular systems, and in gaseous form to the aerial parts. In order of decreasing concentration, the gross distribution of fluorine applied as  $\text{NaF}^{19}$  through the soil was: roots, lower leaves, upper leaves, and stems. Regardless of the path of entrance of the fluorine into the plant, it was possible to wash up to 68 per cent of the fluorine from the leaves with distilled water and up to 83 per cent with water containing a detergent (Tween #20). Distribution based on autoradiograms showed that most accumulation of  $\text{F}^{18}$  applied as  $\text{HF}^{18}$  to tomato plants was at the tips and margins of leaflets and in the glands along the stem. Little  $\text{F}^{18}$  was found in the stems and petioles. In short-term or long-term experiments up to 80 per cent of the  $\text{F}^{18}$  or  $\text{F}^{19}$  of the leaves applied as  $\text{HF}$  was found in the stripped epidermis of Sedum spectabile Boreau. Distribution of  $\text{F}^{18}$  applied as  $\text{HF}^{18}$  to tomato leaves after long-term accumulation was, in order of decreasing concentration: cell walls, chloroplasts, soluble proteins, mitochondria, and microsomes. With short-term accumulation of  $\text{F}^{18}$  applied as  $\text{HF}^{18}$  the order was: soluble proteins, chloroplasts, cell walls, and mitochondria. The fluorine in the chloroplasts was associated mainly with the proteinaceous substances since little or no  $\text{F}^{18}$  was found in the pigments and lipids.

785

UPTAKE OF STRONTIUM-85 BY ALFALFA. C. C. Lee (Univ. of Saskatchewan, Saskatoon, Can.). Science, 138: 41-2(Oct. 1962).

Experiments with alfalfa were carried out to study the possibility of changes with time in the availability of radio-strontium in soil. After the soil was treated once with  $\text{Sr}^{85}$ , the first crop was harvested after 60 days of growth. Four subsequent crops, cut at successive 4-week intervals, were examined. The difference in uptake between the second and fifth crops was statistically significant, suggesting that some fixation of  $\text{Sr}^{85}$  may occur in the soil. The effects of various applications of ammonium dihydrogen phosphate, monocalcium phosphate, calcium chloride, and potassium chloride on the uptake of  $\text{Sr}^{85}$  by alfalfa were also investigated. Of the experiments carried out, only the treatment with 1.0 meq of potassium per 100 g of soil resulted in a statistically significant reduction in strontium uptake.

786

SELECTIVE INHIBITION OF PHOTOSYNTHESIS BY METHANOL IN SCENEDESMUS. Marcel Lefrançois and Cyrias Ouellet. (Laval Univ., Quebec). Can. J. Botany 36, 457-66(1958). (In French). CA-53:2381g.

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MALE STERILE MUTANTS IN THE TOMATO FROM SEED TREATED WITH THE RADIOACTIVE ISOTOPE PHOSPHORUS-32. Margaret M. Lesley and J. W. Lesley. (Univ. of California, Citrus Expt. Sta., Riverside). Proc. Am. Soc. Hort. Sci. 71, 339-43(1958). CA-52: 18692h.

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METABOLISM OF LABELED ACETATE IN BRYOPHYLLUM CALYCINUM. Herbert Lieberman, John E. Christian, and Egil Ramstad. (Purdue Univ., Lafayette, Indiana). J. Am. Pharm. Assoc. 47, 493-6(1958). CA-52: 16502e.

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A/CONF.15/P/558  
OBSERVATIONS ON THE BEHAVIOUR OF PHOSPHATE COMPOUNDS IN CHLORELLA AT THE TRANSITION FROM DARK TO LIGHT. W. Lindeman (Agricultural Univ., Wageningen, The Netherlands). 17p.

Trichloroacetic acid extracts of *Chlorella* cells, which had been labeled with  $\text{P}^{32}$  for 24 hours, were analyzed by paper chromatography. The decrease in orthophosphate and the increase in nucleotides, observed at the transition from dark to light, were considered as indications of light phosphorylation. A rapid decrease in phosphoglyceric acid, interpreted as the reduction of this compound, occurred simultaneously. Since this reduction probably consumed energy-rich phosphate bonds, releasing free orthophosphate, this consumption was considered in estimating the rate of light phosphorylation and the P/O ratio.

790

UNKNOWN METABOLIC INTERMEDIATES IN PLANTS. Pekka Linko. (Biochem. Inst., Helsinki). Acta Chem. Scand. 12, 129-31(1958)(in English). CA-53:4431e.

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EFFECTS OF GIBBERELIC ACID ON THE PHOTO-PERIOD-CONTROLLED GROWTH OF WOODY PLANTS. James A. Lockhart and James Bonner. (California Inst. of Technol., Pasadena). Plant Physiol. 32, 492-4(1957). CA-52-3940c.

792

CONVERSION OF CARBON-14-LABELED SUGARS TO L-ASCORBIC ACID IN RIPENING STRAWBERRIES. II. LABELING PATTERNS IN THE FREE SUGARS. Frank A. Loewus, Rosie Jang, Walter Mann, Jr., and Arthur Bevenus. (Western Regional Research Lab., Albany, Calif.). J. Biol. Chem. 232, 505-19(1958). CA-52: 16503f.

793

CONVERSION OF CARBON-14-LABELED SUGARS TO L-ASCORBIC ACID IN RIPENING STRAWBERRIES. III. LABELING PATTERNS FROM BERRIES ADMINISTERED PENTOSE-1- $\text{C}^{14}$ . Frank A. Loewus, Rosie Jang, Walter Mann, Jr., and Arthur Bevenus. (Western Research Lab., Albany, Calif.). J. Biol. Chem. 232, 521-32(1958). CA-52: 16503i.

794

CONVERSION OF CARBON-14-LABELED SUGARS TO L-ASCORBIC ACID IN RIPENING STRAWBERRIES. IV. A COMPARATIVE STUDY OF D-GALACTURONIC ACID AND L-ASCORBIC ACID FORMATION. Frank

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INCORPORATION OF CARBON-14 INTO TARTARIC ACID AND THE LABELING PATTERN OF D-GLUCOSE FROM AN EXCISED GRAPE LEAF ADMINISTERED L-ASCORBIC ACID-6-C<sup>14</sup>. Frank A. Loewus and Helen A. Stafford. (U. S. Dept. of Agr., Albany, Calif.). *Plant Physiol.* **33**, 155-6 (1958). CA-52: 10302e.

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THE ABSORPTION AND UTILIZATION OF PHOSPHATE BY YOUNG BARLEY PLANTS. IV. THE INITIAL STAGES OF PHOSPHATE METABOLISM IN ROOTS. B. C. Loughman and R. Scott Russell. *J. Exptl. Botany* **8**, 280-93 (1957). CA-52-2180c.

797

METHODS AND EQUIPMENT FOR THE STUDY OF THE INCORPORATION OF PHOSPHORUS BY INTACT BARLEY PLANTS IN EXPERIMENTS OF SHORT DURATION. B. C. Loughman and R. P. Martin. (Univ. Oxford, Engl.). *J. Exptl. Botany* **8**, 272-9 (1957). CA-52-2180a.

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CHANGES IN THE DISTRIBUTION OF GLUCOSE 14C IN ALTERNATIVE CATABOLIC PATHWAYS INDUCED BY KINETIN-ANALOGUE IN THE CALLUS TISSUE OF CARROT (DAUCUS CAROTA L.). J. Lustinec, E. Petru, and V. Pokorna. *Experientia* **18**, 187 (1962)

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ANAEROBIC SYNTHESIS OF STARCH FROM GLUCOSE IN TOBACCO LEAF DISKS. G. A. MacLachlan and H. K. Porter. (Imp. Coll. Sci. and Technol., London). *Biochem. J.* **70**, 11P (1958). CA-53:3381g.

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NITROGEN-15 AS A TRACER OF NITROGEN METABOLISM OF PLANTS. Robert MacVicar (Oklahoma A. and M. Coll., Stillwater). *Publ. Am. Assoc. Advance Sci.* No. 49, 111-22 (1957). CA 53-18188f

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RADIATION EFFECTS ON THE GROWTH AND PHOSPHORUS UPTAKE OF PLANTS GROWN IN SOIL TREATED WITH P<sup>32</sup>. P. G. Marais and S. Fourie (Western Province Fruit Research Station, Stellenbosch, Union of S. Africa). *S. African J. Agr. Sci.* **2**, 3-18 (1959) Mar. (In English)

The effect of radiation from P<sup>32</sup> on the growth and phosphorus uptake of rye and tomato plants was studied in soil culture. The plants were grown for 4, 7, and 12 weeks in two soils which were enriched with phosphate and treated with 0, 4, or 40 microcuries P<sup>32</sup> per pot. The plant tops and roots were analyzed separately. The radiation effects observed were mainly stimulative, but did not vary directly with increasing levels of P<sup>32</sup>. They depended on the species of plant employed, its age, and the soil in which it was grown. Furthermore, the P<sup>32</sup> had a differential effect on the tops and roots, and on the dry weights and phosphorus contents of the plants. The magnitude of these effects was such that the influence of radiation cannot

simply be ignored. It is concluded that in investigations of this type, experimental results must be accepted with reserve unless positive proof is afforded that radiation has had no significant effect.

802

RADIOACTIVITY OF SOILS, PLANT ASHES AND ANIMAL BONES. Ernest Marsden (Royal Cancer Hospital, London). *Nature* **183**, 924-5 (1959) Apr. 4.

Alpha-activity measurements were made of bones of a New Zealand cow and ewe and their offspring. Also some observations on the influence of superphosphate on plant and animal uptake of radioactivity are made.

803

SPECIFICITY OF CHLORIDE DEFICIENCY IN LEMNA MINOR. Georges Martin and Jean Lavollay. *Compt. rend. soc. biol.* **152**, 241-4 (1958). CA-53:3383f.

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UPTAKE AND TRANSLOCATION OF 3-AMINO- AND 3-HYDROXY-1,2,4-TRIAZOLE IN PLANTS. P. Massini. (Philips Research Lab., Eindhoven, Neth.). *Acta Botan. Neerl.* **7**, 524-30 (1958). CA-53:3385a.

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RADIATION GENETICS IN WHEAT. VII. COMPARISON OF RADIATION EFFECTS OF BETA- AND GAMMA-RAYS ON DIPLOID WHEAT. S. Matsumura (National Inst. of Genetics, Misima, Japan). *Radiation Botany*, **1**: 155-64 (Jan. 1962). (In English)

Seeds of *Triticum monococcum flavescens* were soaked in P<sup>32</sup> and I<sup>131</sup> solutions for 2 days before sowing, to compare the effects of beta and gamma radiations. Radioactive solutions of pH 6-7 contained 0.05-0.8 mc/gr P<sup>32</sup> and 0.2-0.8 mc/g I<sup>131</sup>. For comparison, seeds soaked in water for 2 days were exposed to gamma radiation with Co<sup>60</sup> at the dosages 2.5, 5, 10, and 20 kr. The growth of seedlings, height of mature plants, single-spike fertility, and chromosome aberrations of treated plants in X<sub>1</sub> and chlorophyll mutations in X<sub>2</sub> were compared for beta and gamma irradiation. The higher the dosage of beta and gamma rays, the more delayed were emergence and growth of seedlings and the lower were survival rate, height of mature plants, and fertility. The relation between the inhibition of seedling growth and dosage of beta and gamma radiations coincides roughly with that between the decrease of survival rate or fertility and dosage. There was no emergence of seedlings at 20 kr gamma radiation and 0.8 mc/g P<sup>32</sup> beta radiation. The effects of beta radiation from 0.15-0.2 mc/g P<sup>32</sup> and 0.8 mc/g I<sup>131</sup> solutions correspond roughly to those of 2.5 kr gamma radiation. As to chromosome aberrations and chlorophyll mutations, the effects of 2.5 kr gamma radiation coincide roughly with those of 0.1 mc/g P<sup>32</sup> and 0.6-0.8 mc/g I<sup>131</sup> solution. If it is assumed that the effects of beta radiation are confined only to the embryo, then a 0.2 mc/g P<sup>32</sup> solution equals about 2.4 krad. This will account for the present data.

806

CARBON DIOXIDE FIXATION INTO OXALACETATE IN HIGHER PLANTS. Mendel Mazelis and Birgit Vennesland. (Univ. of Chicago). *Plant Physiol.* **32**, 591-600 (1958). CA-52: 7453i.

807

RADIOCARBON STUDIES ON THE TRANSLOCATION OF ORGANIC CONSTITUENTS INTO RIPENING

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TOMATO FRUITS. John P. McCollum (Univ. of Illinois, Urbana) and John Skok. *Proc. Am. Soc. Hort. Sci.* **75**, 611-16(1960).

$P^{32}$ -labeled phosphate applied to leaves or peduncles of tomato plants moved readily into fruits of all maturity stages, regardless of the relative position of leaf and fruit cluster. The movement of  $C^{14}$ -glucose applied to leaves, is governed largely by the vascular anatomy intervening between the site of application and the fruit. If the selected leaf is in the same vertical sector as the fruit, translocation paths for sugar are generally adequate. Under these circumstances, sugar applied to a leaf moved into green fruits and fruits at the turning stage, but not into ripe fruits. In the case of ripe fruit, sugar moved into the peduncle, past the mid-separation zone of the pedicel and up to the calyx, but not past the abscission layer between the calyx end of the pedicel and the fruit. The movement of labeled organic materials into fruits of various stages of maturity may best be determined by labeling the entire photosynthetic supply with  $C^{14}O_2$ . The products of photosynthesis moved most rapidly into the youngest green fruits that were developing rapidly and increasing in size. The rate of movement decreased as the green fruit developed further and reached a low point at the mature green stage when the fruit had attained full size. Activity again increased at the turning stage, indicating a rise in the movement of organic constituents into fruits at incipient coloration. Activity dropped as pigment formation and ripening progressed and became negligible when the fruit had attained the ripe stage. These results indicate that maximum quality of ripe tomatoes would not be impaired if they were harvested just prior to the full-ripe stage on the basis that most of the organic constituents supplied by the leaves had by this time entered the fruits. Such a procedure would take advantage of the reduction in high field losses which are sustained when harvesting is carried out at the full-ripe stage. The results further indicate that the quality of immaturely harvested fruits could be measurably improved if they were harvested when coloration began to appear rather than at the mature green stage as is normally practiced commercially in the green wrap industry. Most of the organic constituents have entered the fruit by about five days or so past the turning stage.

808

STUDIES ON WHEAT PLANTS USING CARBON-14 COMPOUNDS. V. GERMINATION STUDIES WITH LABELED WHEAT SEEDS. W. B. McConnell. (Prairie Regional Lab., Saskatoon). *Can. J. Biochem. and Physiol.* **35**, 1259-66 (1957). CA-52-4758h.

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STUDIES ON WHEAT PLANTS USING CARBON-14 COMPOUNDS. IX. RADIOACTIVITY OF WHEAT FOLLOWING INJECTION OF FORMATE- $C^{14}$  AND GLYCINE-1- $C^{14}$  WITH SPECIAL REFERENCE TO SERINE LABELING. W. B. McConnell and E. Bilinski (Prairie Regional Lab., Saskatoon, Saskatchewan). *Can. J. Biochem. and Physiol.* **37**, 549-55 (1959). CA 53-9392f

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STUDIES ON WHEAT PLANTS USING CARBON-14 LABELED COMPOUNDS. X. THE INCORPORATION OF GLUTAMIC ACID-1- $C^{14}$ . W. B. McConnell (Prairie Regional Lab., Saskatoon). *Can. J. Biochem. and Physiol.* **37**, 933-6(1959). CA 53-18202g

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FEATURES OF PHOSPHORUS METABOLISM IN NUCLEIC ACIDS FORMED DURING VARIOUS PERIODS OF PLANT DEVELOPMENT. Zh. A. Medvedev (K. A. Timiryazev Agr. Acad., Moscow). U.S. At. Energy Comm. AEC-tr-3376, 87-98(1957). CA 53-9375c

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TRANSLOCATION OF CATIONS TO SEEDLINGS OF PINUS VIRGINIANA THROUGH MYCORRHIZAL MYCELIUM. Elisa Melin, Harald Nilsson, and Edward Hacskeylo. (Univ. Uppsala, Swed.). *Botan. Gaz.* **119**, 243-6(1958). CA-52: 20454h.

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FOLIAR RETENTION OF STRONTIUM-90 BY WHEAT. Ronald G. Menzel, Donald L. Myhre, and Howard Roberts, Jr. (U. S. Agricultural Research Service, Beltsville, Md.). *Science*, **134**: 559-60(Aug. 25, 1961).

Wheat harvested from the University of Maryland Agronomy Farm in June 1959 contained 20 to 50 micro-microcuries of strontium-90 per kilogram of grain. More than 90% of the strontium-90 came from deposition on aboveground plant parts, and less than 10% was taken up through the soil. About 1 to 2% of the strontium-90 fallout during the time the heads were exposed was retained in the grain.

814

AECU-4119

Department of Agriculture. Agricultural Research Service, Beltsville, Md.

POLONIUM UPTAKE BY PLANTS. R. G. Menzel. [1953?] 4p. \$1.80(ph), \$1.80(mf) OTS.

Data are tabulated on the uptake of polonium by plants. The distribution of polonium was measured in red clover, Sudan grass, and astragalus following uptake of polonium-210 from solutions.

815

M-7126

Bureau of Plant Industry, Soils, and Agricultural Engineering. Div. of Soil and Plant Relationships, Beltsville, Md.

RUTHENIUM(III) AND IRON UPTAKE BY RED CLOVER FROM NUTRIENT SOLUTION. R. G. Menzel and I. C. Brown. [195?]. 4p. \$1.80(ph), \$1.80(mf) OTS.

Data are presented on the distribution of ruthenium-103-106 and iron in various parts of red clover plants grown in nutrient solutions with various ratios of ruthenium to iron.

816

EVIDENCE FOR AN UNSTABLE CARBON DIOXIDE FIXATION PRODUCT IN ALGAL CELLS. Helmut Metzner, Helmut Simon, Barbara Metzner, and Melvin Calvin. (Univ. of California, Berkeley). *Proc. Natl. Acad. Sci. U.S.* **43**, 892-5(1957). CA-52-3035f.

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LABILE PRODUCTS OF EARLY CARBON DIOXIDE FIXATION IN PHOTOSYNTHESIS. Helmut Metzner, Barbara Metzner, and Melvin Calvin. (Univ. of California, Berkeley). *Arch. Biochem. Biophys.* **74**, 1-6(1958). CA-52: 9330g.

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RELATIVE UPTAKE AND TRANSLOCATION OF POTASSIUM AND CESIUM IN BARLEY. Lawrence J. Middleton, Raymond Handley, and Roy Overstreet (Univ. of

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California, Berkeley). Plant Physiol. 35, 913-18(1960) Nov.

The relative rates of uptake of potassium and cesium by excised roots and by intact plants of barley from solutions have been measured by  $K^{42}$  and  $Cs^{137}$ . The results have been expressed as the observed ratio (O.R.): O.R. =  $(Cs^{137}/K^{42} \text{ plant}) / (Cs^{137}/K^{42} \text{ solution})$ . In excised roots, in external concentrations of potassium up to 1.0 meq/l, the O.R. was in the range of 0.15 to 0.25. At a higher concentration (10 meq/l), the O.R. was approximately 0.4, thus indicating a lower selectivity for potassium at this level. In the transfer from root to shoot, a marked effect of potassium concentration on the O.R. was observed. At a concentration of 0.1 meq/l,  $K^{42}$  was transferred at 10 to 20 times the rate of  $Cs^{137}$  (mean O.R. = 0.06). At 10 meq/l,  $K^{42}$  was transferred at only twice the rate of  $Cs^{137}$  (O.R. = 0.5). When the proportions of added stable potassium and cesium in the medium were varied over a very wide range, the O.R. was affected by a factor of less than two. When the rate of potassium uptake was low or when water movement was restricted, the O.R. in the shoots was greater than unity, showing a greater transference of  $Cs^{137}$ .

819

UPTAKE OF AMINO ACIDS BY THE PEA PLANT (PISUM SATIVUM)--MECHANISM STUDIED USING  $C^{14}$ -LABELED ALANINE AND GLUTAMIC ACID. Jorma K. Miettinen (Biochem. Inst., Helsinki). Suomen Kemistilehti 30B, 30(1957) (in English). CA 53-16295b

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DYNAMIC STUDIES ON NUTRIENT UPTAKE BY CROP PLANTS. XIV. INTAKE AND TRANSFORMATION  $P^{32}$ -PHOSPHORIC ACID IN THE ROOT OF WHEAT SEEDLINGS. Shingo Mitsui, Sueo Aso, and Kozo Ishizuka. (Univ. Tokyo). Soil and Plant Food (Tokyo) 3, 65-9(1957). CA-52: 8302a.

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DYNAMIC STUDIES ON NUTRIENT UPTAKE BY CROP PLANTS. XIV. INTAKE AND TRANSFORMATION OF PHOSPHORUS-32 LABELED PHOSPHORIC ACID IN ROOT OF WHEAT SEEDLINGS. Shingo Mitsui, Sueo Aso, and Kozo Ishizuka (Univ. Tokyo). Nippon Dojo Hiriyogaku Zasshi 28, 262-4(1957). CA 53-8318c

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THE UPTAKE AND UTILIZATION OF CARBON BY PLANTS FROM CARBON-14 LABELED UREA. I. THE DETERMINATION OF RADIOACTIVE CARBON OF PLANT MATERIALS AND A PRELIMINARY SEEDLING EXPERIMENT UTILIZING CARBON-14-LABELED UREA. Shingo Mitsui and Kiyoshi Kurihara (Univ. Tokyo). Nippon Dojo Hiriyogaku Zasshi 28, 439-43(1958). CA 53-19048i

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A/CONF.15/P/1353

THE UTILIZATION OF Ca BY CROP PLANTS FROM Ca-45 LABELED TIME NITROGEN. Shingo Mitsui and Kiyoshi Kurihara (Tokyo Univ.), and Susumu Sonoda, Shoichi Sawayanagi, Teizo Morishita, Toru Hirayama, Kazuyoshi Hamada, and Akira Terakawa (Showa Denko Kabushiki Kaisha, Tokyo). 17p.

Lime nitrogen labeled with calcium-45 was used in a study of the utilization of calcium in lime nitrogen by wheat. Results indicate that calcium in lime nitrogen can serve as a good source of nutrient calcium as well as an acid neutralizing agent.

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ARGININE METABOLISM IN PLANT TISSUES. Georges Morel and Henri Duranton. Bull. soc. chim. biol. 40, 2155-67(1958). CA 53-11535c

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THE PATH OF CARBON IN PHOTOSYNTHESIS. XXIII. THE TENTATIVE IDENTIFICATION OF ERYTHROSE PHOSPHATE. V. Moses and M. Calvin (Univ. of California, Berkeley). Arch. Biochem. Biophys. 78, 598-600(1958) Dec.

Tentative evidence is presented of the occurrence of erythrose 4-phosphate in Chlorella allowed to carry on photosynthesis in the presence of  $C^{14}O_2$ .

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PATH OF HYDROGEN IN PHOTOSYNTHESIS. V. Moses and M. Calvin. (Univ. of California, Berkeley). Biochem. J. 71, 16P(1959). CA-53:5415b.

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PHOTOSYNTHESIS STUDIES WITH TRITIATED WATER. V. Moses and M. Calvin (Univ. of California, Berkeley). Biochim. et Biophys. Acta 33, 297-312(1959).

A study has been made of the incorporation patterns of tritium from tritium oxide by Chlorella cells under conditions of light and dark. A new apparatus has been designed for use in photosynthesis experiments which necessitate the employment of dense cell suspensions and substrates of high specific activity. The incorporation patterns of  $C^{14}O_2$  in the presence and absence of tritiated water showed little evidence of physiological damage due to radiation. The substances incorporating tritium were essentially the same as those incorporating  $C^{14}$  from  $C^{14}O_2$ . However, the percentage distribution of the tracer among the labelled compounds showed considerable differences from the carbon pattern. At the shortest incubation periods in the light, tritium appeared mainly in the sugar monophosphates, phosphoglyceric acid, aspartic acid, glutamic acid, and malic acid. These substances also incorporated label most rapidly in the dark, though in this case a greater percentage of the activity fixed appeared in the amino acids. About three times as much tracer was fixed in the light as in the dark. The total activity fixed, and its distribution, was affected to some extent by the presence of ammonium or nitrate ions in the medium. Glycolic acid was labelled very early, and was the most active compound present. A scheme for hydrogen transport in photosynthesis involving an alternate oxidation and reduction of glycolic and glyoxylic acids is proposed. The difficulties of interpreting the results of biochemical studies with hydrogen isotopes due to non-specific exchange reactions are discussed.

828

RESPONSE OF CHLORELLA TO A DEUTERIUM ENVIRONMENT. V. Moses, O. Holm-Hansen, and M. Calvin. (Univ. of California, Berkeley). Biochim. et Biophys. Acta 28, 62-70(1958). (in English). CA-52: 12103e.

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ACTION OF LIGHT UPON  $\beta$ -CARBOXYLATION AND OXIDATION IN THE LEAVES OF BRYOPHYLLUM. A. Moyse and G. Jolchine. Bull. soc. chim. biol. 39, 725-45(1957). CA-52: 9319e.

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EFFECTS OF INDOLEACETIC ACID ON THE UTILIZATION OF ACETATE- $1\text{-C}^{14}$  BY PEA STEM SLICES. James F. Nance. (Univ. of Illinois, Urbana). *Plant Physiol.* **33**, 93-8(1958). CA-52: 10301b.
- 831**  
AN ABNORMAL NUCLEOLAR CONDITION INDUCED IN CORN BY RADIOACTIVE PHOSPHORUS TREATMENT. A. T. Natarajan and M. S. Swaminathan (Indian Agr. Research Inst., New Delhi). *Naturwissenschaften* **45**, 494-5(1958) (in English). CA 53-10397i
- 832**  
THE BIOSYNTHESIS OF CELL-WALL CARBOHYDRATES. IV. FURTHER STUDIES ON CELLULOSE AND XYLAN IN WHEAT. A. C. Neish. (Prairie Regional Lab., Saskatoon). *Can. J. Biochem. and Physiol.* **36**, 187-93(1958). CA-52: 7449i.
- 833**  
NOTE ON A RAPID TRANSLOCATION OF PHOTO-SYNTHETICALLY ASSIMILATED CARBON- $14$  OUT OF THE PRIMARY LEAF OF THE YOUNG SOYBEAN PLANT. C. D. Nelson, Harold J. Perkins, and Paul R. Gorham. (National Research Council, Ottawa, Can.). *Can. J. Biochem. and Physiol.* **36**, 1277-9(1958). CA-53:3398c.
- 834** (UCLA-468) A COMPARISON OF UPTAKE OF STRONTIUM $^{90}$  AND CESIUM $^{137}$  BY BRYOPHYTES AND VASCULAR PLANTS. H. Nishita, D. Dixon, and K. H. Larson (California Univ., Los Angeles. School of Medicine). Dec. 19, 1960. Contract AT(04-1)-GEN-12. 7p.  
An experiment was conducted to compare the uptake of  $\text{Sr}^{90}$  and  $\text{Cs}^{137}$  by bryophytes and higher sporophytic plants grown on contaminated soil.
- 835** INCORPORATION OF  $\text{Sr}^{90}$ - $\text{Y}^{90}$  IN PLANTS: RADIOAUTOGRAPHIC STUDY OF INCORPORATION IN VICIA FABA. Constantino Nuñez. Rev. pubs. navales, **14**: 1-17(Jan.-Feb. 1961). (In Spanish)  
Studies performed in *Vicia faba* using radioautographic techniques orientated to demonstrate the  $\text{Sr}^{90}$  metabolism showed the active circulation of the radioelement in the conduction (vascular) system of the plant which contrasts with a low cell incorporation of  $\text{Sr}^{90}$  showed by autoradiographs. In radioautographs of high resolution, meristematic cells showed a low protoplasmatic incorporation around the nucleus, with an aspect of perinuclear crown. Radioautographs of stem and leaves showed a progressive and strong decrease of circulation through feeble or negative macroradiographs and negative autoradiographs. These findings suggest that the radioelement circulates actively through the plant without metabolism in parenchymatic tissues or, at least, in a very feeble condition in cellular groups with a very high metabolic activity (meristematic cells of the root), and that  $\text{Sr}^{90}$  distribution is highly reduced in stem and leaves. This behavior would confirm the importance of direct deposition mechanism of  $\text{Sr}^{90}$  from fall-out on the surface of leaves in the first step of food chains.
- 836**  
ACTIVATION OF BASAL PROCESSES (METABOLIC AND ENZYMIC) IN BARLEY BY ULTRASONICS. Georges Obolensky. (Univ. Paris). *Materiae Vegetabiles (The Hague)* **2**, 298-335(1957). (in French). CA-52: 13020h.
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IMPORTANCE OF BIOPOTENTIALS TO ENTRANCE AND MOVEMENT OF SUBSTANCES IN PLANTS. V. A. Opritov. (N. I. Lobachevskii State Univ., Gorki). *Biofizika* **3**, 38-44(1958). CA-52: 12107d.
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EFFECT OF WATER STRESS ON THE CELL-WALL METABOLISM OF PLANT TISSUE. L. Ordin (Agr. Research Sta., Rehovot, Israel). *Radioisotopes Sci. Research, Proc. Intern. Conf., Paris, 1957*, **4**, 553-64(Pub. 1958). CA 53-20311i
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INFLUENCE OF NITROGEN FERTILIZATION AND CLIPPING ON GRASS ROOTS. D. L. Oswalt, A. R. Bertrand, and M. R. Teel (Purdue Univ., Lafayette, Indiana). *Soil Sci. Soc. Am., Proc.* **23**, 228-30(1959). CA 53-19260h
- 840** A/CONF.15/P/1494  
AN APPROACH FOR USING LABELLED RADIOACTIVE PHOSPHORUS ( $\text{P}^{32}$ ) IN PHYSIO-PATHOLOGICAL STUDIES OF PLANT-NEMATODE DISEASES. B. A. Otieta, Y. Barrada, and D. M. El Gindi (Cairo Univ., Giza, Egypt). 12p.  
Results are reported from a study of the effect of the rootknot nematode, *Meloidogyne javanica*, on the nutritional status of one-month old tomato plants. The uptake of phosphorus-32 from nutrient solution by various parts of the plant was measured.
- 841**  
RESULTS OF RADIOACTIVE POTASSIUM ON GROWTH OF PLANTS. E. I. Panteleeva. *Zapiski Leningrad. Sel'skokhoz. Inst.* **1956**, No. 11, 208-11. CA-52: 20426e.
- 842** CARBON ISOTOPE FRACTIONATION DURING PHOTOSYNTHESIS. R. Park and S. Epstein (California Inst. of Tech., Pasadena). *Geochim. et Cosmochim. Acta*, **21**: 110-26(1960). (In English)  
A study was made of the reasons for isotopic fractionation in photosynthesis and the various factors controlling it.  $\text{CO}_2$  samples from plants, air, and calcium carbonate were analyzed in a mass spectrometer in order to determine  $\text{C}^{13}/\text{C}^{12}$  and  $\text{O}^{18}/\text{O}^{16}$  ratios. The relative isotopic compositions of the samples and the fractionation factor between  $\text{CO}_2$  and fixed plant carbon were determined. The effects of high light intensities on the fractionation factors of photosynthesis were studied. Results indicated that greater  $\text{C}^{12}$  enrichment occurred at high  $\text{CO}_2$  concentrations and that light intensity was not important. Experiments on the extraction of "dissolved  $\text{CO}_2$ " and on the enzymic fixation of carbon dioxide suggested that the major fractionation of carbon isotopes in the photosynthetic fixation of atmospheric  $\text{CO}_2$  is due to two steps. The first step involves the preferential uptake of  $\text{C}^{12}$  from the atmosphere and the second step the preferential conversion of  $\text{C}^{12}$ -rich "dissolved  $\text{CO}_2$ " to phosphoglyceric acid, the first product of photosynthesis. Subsequent metabolism of photosynthetic products was accompanied by isotope fractionation. However, these fractionations affected the



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isotopic composition of only a few minor constituents of the plant.

**843** METABOLIC FRACTIONATION OF  $C^{13}$  &  $C^{12}$  IN PLANTS. Roderic Park and Samuel Epstein (California Inst. of Tech., Pasadena). *Plant Physiol.*, 36: 133-8 (Mar. 1961).

$C^{13}/C^{12}$  ratio analyses of chemical fractions from several plant phyla show that in all cases the lipid fraction is enriched in  $C^{12}$  compared to the whole plant. The  $C^{13}/C^{12}$  ratio of the plant lipids corresponds roughly to the  $C^{13}/C^{12}$  ratio of petroleum. The  $C^{12}$  enrichment in petroleum as compared to present day plants can be explained if selective preservation of plant lipids occurred during the sedimentation process. The degree of  $C^{12}$  enrichment in the plant lipid fraction is inversely related to the amount of lipid in the plant. The  $C^{12}$  enrichment which occurs in plant lipids may be balanced by the  $C^{13}$  enrichment which occurs in respired  $CO_2$ . Isotope selection at the level of acetate or pyruvate is a possible mechanism for explaining our results.

**844** THE PROCESSES OF PHOTOSYNTHESIS IN THE LIGHT OF RECENT RESEARCH WITH  $C-14$  RADIO-ACTIVE CARBON. M. Parovina. *Minerva Med.* 53, 1018-21 (1962) Apr.

**845** ACCUMULATION OF CAESIUM-137 BY PLANTS GROWN IN SIMULATED POND, WET MEADOW AND IRRIGATED FIELD ENVIRONMENTS. R. C. Pendleton and R. L. Uhler (General Electric Co., Richland, Wash.). *Nature* 185, 707-8 (1960) Mar. 5.

The availability of cesium-137 to plants was examined under conditions simulating shallow ponds, wet meadows, and irrigated fields. The uptake ratio was found to be 450:30:1. Implications are discussed of the findings on plant uptake of and subsequent incorporation into the food chain of cesium-137 from fall-out.

**846** A TISSUE-AUTORADIOGRAPHIC STUDY OF THE TRANSLOCATION OF CARBON-14-LABELED SUGARS IN THE STEMS OF YOUNG SOYBEAN PLANTS. Harold J. Perkins, C.D. Nelson, and Paul R. Gorham (Nat'l. Research Council, Ottawa). *Can. J. Botany* 37, 871-7 (1959) CA 53-22294h

**847** TOPOCHEMICAL INVESTIGATIONS ON POST MEIOTIC POLLEN MITOSIS IN FRITILLARIA MELEAGRIS. Hans H. Pfeiffer. (Lab. Polar-Microscopy, Bremen, Ger.). *Ber. deut. botan. Ges.* 70, 217-20 (1957). CA-52: 10298g.

**848** (TID-11156) PHYSIOLOGICAL CROP ECOLOGY USING RADIOISOTOPES. Annual Report for Year June 1, 1960 to February 28, 1961. (Minnesota. Univ., St. Paul. Inst. of Agriculture). Nov. 1960. 64p. Contract AT(11-1)-783.

Investigations were made on the circulation pattern for the translocation of  $P^{32}$  in soybean. Application of  $P^{32}$  to cotyledons, primary leaves, and the first trifoliate leaf was made at intervals of from 2 to 5 days during the lives of the organs. The subsequent movement of  $P^{32}$  was observed. Translocation of  $P^{32}$  in adult corn plants was studied in

order to find an efficient and safe method of applying  $P^{32}$  to corn. Two methods were tried, one using lanolin and one Van Tieghem cells. The latter was found to be the most effective. Studies were continued on the patterns of translocation in pea plants particularly in respect to flowering and fruiting. Studies confirmed earlier work showing that there is a strong direction of movement of material from the bloom node leaf to the fruit at that node. Distribution patterns for  $C^{14}$  supplied as  $C^{14}O_2$  and for  $P^{32}$  were studied for pea. The rate of movement of  $P^{32}$  across the epidermis of oats, wheat, and onion was found to be from 50 to 150 cpm per second. Most uniform results were obtained with onion. The movement of  $P^{32}$ ,  $Zn^{65}$ ,  $S^{35}$ , and  $Sr^{89}$  in the mycelium of *Rhizoctonia solani* was observed. These studies demonstrate conclusively that soil fungi can translocate radioisotopes *in vitro*. This is part of a study to determine the effectiveness of soil fungi in translocating materials *in situ* in the soil. Studies were continued on the exchange of foliarly applied  $P^{32}$  between soybeans and its weed competitors. Additional equipment has been installed in the field laboratory at Rosemount. These include the thermocouple network and panel. The records are being taken on solar radiation, precipitation, and wind velocity and direction. The experimental plots involving a 5-crop rotation were established. Field plots for the placement of  $Sr^{90}$  were prepared in order to study the uptake and movement of  $Sr^{90}$  in soybeans and corn.

**849** UPTAKE OF RADIOSTRONTIUM BY AN ALGA, AND THE INFLUENCE OF CALCIUM ION IN THE WATER. D. C. Pickering and J. W. Lucas (Coll. of Tech., Liverpool). *Nature*, 193: 1046-7 (Mar. 17, 1962).

The uptake of radiostrontium by the algae *Rhizoclonium hieroglyphicum* was studied with respect to the effects of  $Ca^{2+}$  ions in the water. Equilibrium between the algae and the water (pH 5.8) was found to be reached in ~10 days. The Sr and Ca results for the algae are presented as plots of the logarithm of the concentration factor of Sr or Ca in the algae vs the logarithm of the  $Ca^{2+}$  concentration in water ( $\mu M/g$ ), and the curves are fitted by the equations  $\log CF_{Sr} = 2.17 - 1.05 \log [Ca^{2+}]$  and  $\log CF_{Ca} = 2.16 - 0.935 \log [Ca^{2+}]$ . The calculated discrimination factor (Sr/Ca) shows that the algae discriminates in favor of Sr at low  $Ca^{2+}$  concentrations.

**850** THE STABILITY OF ACCUMULATION COEFFICIENTS FOR  $Sr^{90}$ ,  $Y^{91}$  AND  $Ce^{144}$  IN SEA ALGAE. G. G. Polikarpov (Kovalevskii Sevastopol Biological Station, Academy of Sciences, SSSR). *Doklady Akad. Nauk S.S.S.R.*, 140: 1192-4 (Oct. 11, 1961). (In Russian)

Samples of *Cystoseira barbata* and of a large brown seaweed from the Black Sea (*Cystoseira*) were grown in 2.5-liter, glass aquariums containing  $10^{-5}$  curies/l of  $Sr^{90}$  and  $Ce^{144}$  ( $10^{-6}$  and  $10^{-9}$  g/l respectively). The activity content of  $Sr^{90}$  and  $Ce^{144}$  was kept at the same level by adding  $2.5 \times 10^{-5}$  curies to each aquarium each day. Distribution coefficients were determined at different concentrations of activity in order to find out whether there was a variation in the distribution coefficient as a function of concentration. Equilibrium was attained in two days for  $Sr^{90}$  and in six days for  $Ce^{144}$ . It was found that the distribution coefficients remained constant for  $Sr^{90}$ ,  $Y^{91}$  and  $Ce^{144}$  within the limits of experimental error. The distribution coefficients were found to be 300 for  $Sr^{90}$  and 2100 for  $Ce^{144}$ , and did not vary significantly whether the experiment was run with a single dose of tracer or with a multiple dose of tracer. Thus, the distribution coefficients were found to be stable in spite of

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a considerable variation in concentration of the isotopic carrier.

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THE PATH OF ENTRY OF COBALT-60 INTO WHEAT SEED. Ivan D. Popov and V. Khristov. Compt. rend. acad. bulgare sci. **10**, 73-6 (1957). CA-52: 7449a.

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TRACING THE PATH OF THE TRANSPIRATION STREAM IN TREES BY THE USE OF RADIOACTIVE ISOTOPES. S. N. Postlethwait and Bruce Rogers. (Purdue Univ., Lafayette, Indiana). Am. J. Botany **45**, 753-7 (1958). CA-53:6361g.

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INCORPORATION OF MEVALONIC ACID INTO TOMATO CAROTENOIDS. A. E. Purcell, G. A. Thompson, Jr., and James Bonner (California Inst. of Technol., Pasadena). J. Biol. Chem. **234**, 1081-4 (1959). CA 53-15231g

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CYANIDE EFFECTS ON CARBON DIOXIDE FIXATION IN CHLORELLA. B. R. Rabin, D. F. Shaw, N. G. Pon, J. M. Anderson, and M. Calvin. (Univ. of California, Berkeley). J. Am. Chem. Soc. **80**, 2528-32 (1958). CA-52: 18696g.

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SITE OF PROTEIN SYNTHESIS IN LEAVES. David Racusen and E. L. Hobson (Shell Develop. Co., Modesto, Calif.). Arch. Biochem. Biophys. **82**, 234-6 (1959). CA 53-15230i

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RADIOISOTOPES IN SOIL-PLANT NUTRITION STUDIES. Proceedings of the Symposium held in Bombay, 26 February-2 March 1962. (International Atomic Energy Agency, Vienna). Proceedings Series. June 1962. 469p. (STI/PUB/55). \$9.00; 189s.; NP 36; DM 31.50 (IAEA).

A symposium on Radioisotopes in Soil-Plant Nutrition Studies was held at Bombay, Feb. 26 to March 2, 1962.

Separate abstracts were prepared for 8 papers; abstracts of 2 papers have appeared previously in NSA. Other papers presented covered various aspects of soil chemistry, soil physics, ion uptake and translocation in soils, biological measurement of soil characteristics, and fertilizer usage.

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SEASONAL ABSORPTION AND EXCRETION CYCLE OF PHOSPHORUS BY THE ROOT OF WOODY PLANTS. I. N. Rakhtenko. (Inst. Biol., Acad. Sci. White Russian S.S.R., Minsk). Fiziol. Rastenii, Akad. Nauk S.S.S.R. **5**, 447-50 (1958). CA-53:3387h.

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STUDIES ON THE DISCRIMINATION OF  $Sr^{90}$  FROM DIP-

LOID AND TETRAPLOID RED CLOVER AND  $Ca^{45}$  IN FEEDING EXPERIMENTS WITH MICE. Bertil Rasmuson and Bo Gahne (Inst. of Plant Systematics and Genetics, Uppsala), and Lars Fredriksson (National Agronomy Experiment Station, Uppsala). Kgl. Lantbruks-Högskol. Ann. **25**, 241-51 (1959)

Diploid and tetraploid red clover was cultivated on different Ca levels with a constant addition of  $Sr^{90}$  in the soil. At all levels the diploid showed a greater uptake of both Ca and  $Sr^{90}$  per dry weight. The uptake of  $Sr^{90}$  from this diploid and tetraploid clover was investigated with mice as experimental animals on an adequate synthetic diet with calcium derived solely from the clover. There was no divergence in percentual uptake of  $Sr^{90}$  from the diploid clover and from the tetraploid, but the total difference in  $Sr^{90}$  activity that was found in the plant material was retained in the animal body. To the diet was added  $Ca^{45}$  to compare the strontium and calcium metabolism. The mice discriminated against strontium in relation to calcium ( $OR_{body-diet} = 0.27$ ). The major discriminating factors were computed ( $DF_{absorptive} = 0.45$  and  $DF_{urine} = 0.58$ ). Consideration must be taken of the fact that  $Sr^{90}$  was derived from plant material.

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INCORPORATION OF CARBON-14 INTO TOBACCO LEAVES WITH PARTICULAR REFERENCE TO POLYPHENOLS. W. W. Reid (Carreras, Ltd., London). Tabacco Sci. **3**, 109-12 (Pub. in Tobacco **149**, No. 4, 20-3 (1959). CA 53-19311d

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THE STIMULATORY EFFECT OF 3-INDOLEACETIC ACID ON THE UPTAKE OF AMINO ACIDS BY TISSUE OF HELIANTHUS ANNUUS. Leonora Reinhold and R. G. Powell. (Univ. Oxford, Engl.). J. Exptl. Botany **9**, 82-96 (1958). CA-52: 18677g.

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METABOLISM OF CARBON-14-LABELED FERULIC ACID IN PLANTS. II. PARTICIPATION IN THE BIOGENESIS OF FLAVONOIDS. Hans Reznik and Rosmarie Urban. (Heidelberg Univ., Ger.). Naturwissenschaften **44**, 592-3 (1957). CA-52: 93:5c.

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TRACING CHANGES IN ISOTOPIC COMPOSITION OF Sr, Rb, Ca, K, AND Li WHEN ASSIMILATED BY PLANTS FROM THE NUTRIENT MEDIUM. G. R. Rick, O. N. Petrova, L. A. Misyuk, and L. V. Platonova (All-Union Lenin Academy of Agricultural Sciences, Leningrad). Biophysics (U.S.S.R.) (English Translation), **6**: No. 6, 94-7 (1961).

The possibility of changes in the isotopic composition of Sr, Rb, Ca, K, and Li assimilated by plants from the nutrient medium was investigated in spring wheat, rice, tomato, and sunflower plants. A mass spectrometer was used to determine the isotopic composition of plant ashes and nutrient solution. Data are tabulated. No change in the isotopic composition was found for the elements tested when assimilated by plants from the nutrient medium.

864

MOVEMENT OF SEVERAL RADIOACTIVE ISOTOPES IN PEPPERMINT USING A SPLIT ROOT TECHNIQUE. Robert William Rinne (Purdue Univ., Lafayette, Ind.). Dissertation Abstr., **22**: 3361 (Apr. 1962).

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Studies were conducted with four objectives in mind: first, to point out the characteristics of a peppermint plant which make it ideally suited as a test plant for ion movement studies; second, to study the movement of several radioactive isotopes in a modified peppermint plant by feeding the isotopes to just two vascular bundles of the peppermint plant; third, to try and account for any gross differences in the movement of the radioactive isotopes used in the second portion of the study; fourth, to show the effects of varied phosphorus levels on the ultimate distribution of radioactive phosphorus in the peppermint plant. The first study showed that the peppermint plant can be modified to any number of oppositely paired leaves by removing the apical portion and the lateral shoots can be removed without influencing the basic pattern of ion movement in the plant. Also pointed out was the fact that any of the four main vascular bundles of the peppermint plant may be fed an isotope separately or in any combination.

In the second study three different patterns of movement were observed. The first pattern was distinct for iron-59, sulfur-35, zinc-65, and cobalt-60. These isotopes showed a distribution in the A', B' sections of the odd numbered leaves and in the A, A' sections of the even numbered leaves. The second type of pattern was distinct for chlorine-36. Chlorine-36 was distributed mainly in the A', B' sections of the odd numbered leaves. Some lateral movement of the chlorine-36 did take place into the A, B sections of the odd numbered leaves. The distribution of the chlorine-36 was quite irregular into the even numbered leaves. The third pattern of movement was distinct for rubidium-86 and calcium-45. These two isotopes were distributed in the A, B and A', B' sections of the odd numbered leaves. The even numbered leaves also contained the isotopes throughout the A, B and A', B' sections. The third study pointed out that the distribution of the calcium-45 into the A and B sections of the odd numbered leaves observed in the second study was due to a lateral movement of the calcium-45 out of the vascular bundles to which it was fed and into the vascular bundles which were not fed. The calcium-45 moved laterally only in the internode tissue. The fourth study pointed out that phosphorus-32 can be induced to move laterally to a phosphorus deficient area in the peppermint plant.

**865** A/CONF.15/P/1295  
RECHERCHES SUR LA PENETRATION DU ZINC DANS LES CARYOPSES ET LES SEMENCES AU MOYEN DE LEUR TRAITEMENT PAR  $ZnSO_4$  MARQUE AVEC DU ZINC RADIOACTIF 65. (Research Into the Effect of Zinc on the Biological Processes of Some Plants with the Help of Radioactive Zinc ( $Zn^{65}$ ).) R. Ripan, E. Pop, I. Ciobanu, T. Marco, and G. Marco (Université "Victor Babes," Cluj). 10p.

A study was made of the effect of small amounts of zinc on the growth of the seeds of some cereals. The study was conducted by varying the time and the zinc concentration.  $Zn^{65}$ -labeled  $ZnSO_4$  was used. It was shown that the penetration of zinc into the caryopses and seeds was slow in *Zea mays* and more rapid in *Phaseolus vulgaris*. An increase in the uptake occurred in both cereals with an increase in the concentration of the solution. In a comparison of the zinc distribution, it was found that the pericarp of the caryopses of *Zea mays* retains a larger quantity than the seed tegument of *Phaseolus vulgaris*, and the endosperm a smaller quantity than the seed cotyledon.

**866** INFLUENCE OF Ca AND Sr AMENDMENTS ON  $Sr^{90}$  UPTAKE BY LADINO CLOVER UPON PROLONGED CROPPING. E. M. Romney, G. V. Alexander, H. Nishita, and K. H. Larson (Univ. of California, Los Angeles). Soil Sci. Soc. Am. Proc., 25: 299-301 (July-Aug. 1961). (UCLA-462)

Prolonged cropping experiments showed that a single application of  $CaCO_3$  in the amount recommended to produce better crop growth (2 to 5 tons an acre) continued to suppress  $Sr^{90}$  uptake from an acidic soil that initially was deficient in plant-available Ca. This effect of treatment is attributable to the complementary ion influence of Ca on Sr. The cumulative amount of  $Sr^{90}$  removed by 15 successive cuttings of ladino clover was 29.38, 15.71, and 11.61% of the dose from Sassafras sandy loam treated with  $CaCO_3$  at levels of 1, 5, and 10 mc Ca per 100 g soil (equivalent to 0.5, 2.5 and 10 tons  $CaCO_3$  an acre, respectively). The greatest amount of the  $Sr^{90}$  dose removed from the soil

by a single clover cutting was 0.38% at the 1 mc Ca treatment. A single application of  $Sr(NO_3)_2$  amendment at levels of 0.05, 1, and 2 mc Sr per 100 g soil (equivalent to 0.05, 1 and 2 tons  $Sr(NO_3)_2$  an acre) initially increased plant uptake of  $Sr^{90}$  from Hanford sandy loam as a result of the displacement of  $Sr^{90}$  from the exchange complex by stable Sr into the soil solution where it was more readily available to the plant. This enhancing effect of low levels of Sr amendment on  $Sr^{90}$  uptake became less apparent as time progressed. The carrier-dilution effect of reducing plant uptake of  $Sr^{90}$  from Hanford sandy loam was achieved by applying  $Sr(NO_3)_2$  at a level of 10 mc Sr per 100 g soil (equivalent to 10 tons  $Sr(NO_3)_2$  an acre).

**867** INFLUENCE OF STABLE Sr ON PLANT UPTAKE OF  $Sr^{90}$  FROM SOILS. E. M. Romney, G. V. Alexander, G. M. le Roy, and K. H. Larson (Univ. of California, Los Angeles). Soil Sci. 87, 42-5 (1959) Jan.

Varied treatments of  $Sr(NO_3)_2$  and  $SrSO_4$  were applied to three different types of  $Sr^{90}$ -contaminated soil to determine to what extent stable Sr might reduce plant uptake of radiostrontium by the effect of carrier dilution. Applications of stable Sr at levels ranging from 0.1 to 5.0 me. Sr per 100 g. of air-dry soil increased the uptake of  $Sr^{90}$  by beans and Ladino clover. Stable Sr displaced  $Sr^{90}$  adsorbed on the soil exchange complex into the soil solution where it was more readily available to the plant. This effect was most apparent in an acidic soil containing a very low level of native Sr. Stable Sr uptake was linear with respect to the level of exchangeable Sr in the soil; however, the total amount of Sr accumulated by the plant was dependent upon the available soil calcium. Plants obtained more stable Sr from  $Sr(NO_3)_2$ -treated soils than from  $SrSO_4$ -treated soils. The levels of stable Sr required to effectively reduce plant uptake of  $Sr^{90}$  from soils by carrier dilution were greater than 5.0 me. Sr per 100 g. of soil, that is, equivalent to more than about 5 tons of Sr amendments an acre.

**868** PLANT UPTAKE OF STRONTIUM-90, YTTRIUM-91, RUTHENIUM-106, CESIUM-137, AND CERIUM-144 FROM SOILS. E. M. Romney, J. W. Neel, H. Nishita, J. H. Olafson, and K. H. Larson. (Univ. of California, Los Angeles). Soil Sci. 83, 359-76 (1957). CA-52-4901g.

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- Dry yield of wheat grown for 117 days was not affected by solutions of nuclear reactor-produced mixed fission products (MFP) applied to the soil surface or mixed with equal amounts of potted soil at contamination level ranging from 0.01 to 1.0  $\mu\text{C}$  beta activity per g of soil. Concentrations of beta and gamma activity in the above-ground parts of plants were increased as the soil contamination levels increased. Wheat removed from 0.07 to 0.09% of the total beta activity that had been mixed with the soil and from 0.10 to 0.15% of that which had been applied to the soil surface. Concentrations of radioactivity in above-ground plant parts were highest in leaves, intermediate in stems and lowest in fruiting heads. Radiostromtium accounted for 50 to 80% of the beta activity transferred to above-ground plant parts; <10% was attributable to root transfer of  $\text{Y}^{91}$ ,  $\text{Ru}^{106}$ ,  $\text{Cs}^{137}$ , and  $\text{Ce}^{144}$  from soil
- 870** FORMATION OF OXALACETATE AND ASPARTATE FROM PHOSPHOENOL-PYRUVATE IN SPINACH LEAF CHLOROPLAST EXTRACT. Lawson L. Rosenberg, John B. Capindale, and F. R. Whatley. (Univ. of California, Berkeley). *Nature* 181, 632-3 (1958). CA-52:12093h.
- 871** FORMATION OF ALKYL PHOSPHATES IN WHEAT LEAVES. V. C. Runeckles. (Queen's Univ., Kingston, Can.). *Nature* 181, 1470-1 (1958). CA-52: 17422h.
- 872** ABSORPTION AND DISTRIBUTION OF STRONTIUM IN PLANTS. I. PRELIMINARY STUDIES IN WATER CULTURE. R. Scott Russell and Helen M. Squire (Univ. Oxford, Engl.). *J. Exptl. Botany* 2, 262-76 (1958). CA 53-11529d
- 873** A/CONF.15/P/287  
THE AVAILABILITY TO PLANTS OF DIVALENT CATIONS IN THE SOIL. R. Scott Russell, R. K. Schofield, and P. Newbould (Agricultural Research Council, Grove, Berks, Eng.). 9p.
- Methods for characterizing the equilibrium soil solution are described and are applied to experiments in which soils used in pot culture experiments were labelled with  $\text{Ca}^{45}$  and  $\text{Sr}^{89}$ . Six soils showing a wide range of characteristics were used. In all soils the ratio of  $\text{Sr}^{89}$  to  $\text{Ca}^{45}$  or to stable calcium in the equilibrium solution was less than the ratio of exchangeable  $\text{Sr}^{89}$  to  $\text{Ca}^{45}$  or to stable calcium. The extent to which the ratios differed varied between soils. Three of the soils contained calcium carbonate which somewhat complicates the interpretation. Moreover, when calcium hydroxide was added to these soils varying amounts of calcium carbonate were precipitated. When this occurred after  $\text{Ca}^{45}$  had been added, some of it was precipitated with  $\text{Ca}^{45}$ . The ratio of strontium to calcium absorbed from soil by barley and cabbage showed reasonable agreement with that observed when the plants were grown in nutrient solutions similar in composition to the equilibrium soil solution.
- 874** RATE OF ENTRY OF RADIOACTIVE STRONTIUM INTO PLANTS FROM SOIL. R. Scott Russel and G. M. Milbourn (Agricultural Research Council Radiobiological Lab., Compton, Nr. Newbury, Berks). *Nature* 180, 322-4 (1957) Aug. 17.
- 875** UPTAKE OF STRONTIUM BY PASTURE PLANTS AND ITS POSSIBLE SIGNIFICANCE IN RELATION TO THE FALLOUT OF STRONTIUM-90. R. S. Russell and R. J. Garner. *Nature (Lond)* 183, 1806-7 (1959) June
- 876** DISTRIBUTION OF STRONTIUM ABSORBED BY RICE PLANT AT DIFFERENT STAGES OF GROWTH. Takashi Sakaguchi, Zenzaburo Kasai, and Azuma Okuda. (Kyoto Univ.). *Mem. Research Inst. Food Sci. Kyoto Univ.* No. 15, 12-15 (1958). CA-53: 5051.
- 877** (UCRL-Trans-737) INCORPORATION OF  $\text{O}^{18}$  FROM HEAVY OXYGEN WATER IN VIOLAXANTHENE UNDER THE EFFECT OF LIGHT ON PLANTS. D. I. Sapozhnikov, D. G. Alkhazov, Z. M. Eidel'man, N. V. Bazhanova, I. Kh. Lemberg, T. G. Maslova, A. B. Girshin, I. A. Popova, V. S. Saakov, O. F. Popova, and G. A. Shiryaeva (Shiriaeva). Translated by S. Shewchuck (Univ. of California Lawrence Radiation Lab., Berkeley) from *Botan. Zhur.*, 46: 673-6 (1961). 12p.
- The investigation was conducted on *Elodea canadensis* and *Chlorella pyrenoidosa* using heavy-oxygen water of 17 and 23% enrichment, respectively. The plants were: I. exposed to heavy-oxygen water and light; II. exposed to heavy-oxygen water and darkness; and III. ordinary water and light. The violaxanthene was extracted from the plants and exposed to protons to convert the incorporated  $\text{O}^{18}$  to  $\text{F}^{18}$ . The  $\text{F}^{18}$  was detected in I., and not detected in II. and III.; thus indicating that light causes the plant to take up the  $\text{O}^{18}$  and incorporate it in the violaxanthene
- 878** FORMATION OF HOMOSERINE DURING GERMINATION OF THE PEA. Kei Sasaoka. (Kyoto Univ.). *Mem. Research Inst. Food Sci., Kyoto Univ.* No. 14, 42-8 (1958). CA-52: 11192d.
- 879** TRANSFORMATION OF THIOUREA- $\text{S}^{35}$  IN POTATO TUBERS. N. A. Satarova. (K. A. Timiryazev Inst. Plant Physiol., Moscow). *Doklady Akad. Nauk S.S.S.R.* 122, 528-31 (1958). CA-53: 1473f.
- 880** STRONTIUM-90 UPTAKE BY UNDERGROUND PLANT PARTS. E. L. Sattler. p.112-15 of "Radiostromtium." Strahlenschutz No. 18. Munich, Gersbach & Sohn Verlag, 1961.
- Since 1957 potato and soil samples have been taken from ten different soil types in Hesse. The  $\text{Sr}^{90}$  contamination of the underground plant constituents was determined, the motion of the activity was followed during the year, and the effect of the various soils was determined. The results obtained showed that the separation factor (observed ratio) generally increases with the Ca concentration. The dependence of the observed ratio on the ratios  $\text{Ra}/\text{Ca}$  or  $\text{Sr}/\text{Ca}$  in the soil is given. The results only illustrate the tendency that a preferred Sr uptake is connected with increasing Ca content.

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THE BEHAVIOR OF STRONTIUM-90 IN SOILS AND PLANTS AND AGRICULTURAL PRECAUTIONS FOR LESSENING THE STRONTIUM-90 CONTAMINATION OF FOOD. F. Scheffer and F. Ludwig (Univ. of Göttingen, Ger.). Atompraxis 4, 416-19(1958). (In German)  
The development of dirty atom bombs (hydrogen bombs with a uranium mantle) and the resultant high radioactive fall-out have made the strontium-90 contamination of foodstuffs a serious problem for humanity. The literature of recent years is used to survey the behavior of strontium-90 in plants and soil, and to discuss agricultural measures which could be taken to lessen the contamination of foodstuffs in case of atomic warfare.
- 883** CEA-tr-A-661  
COMPORTEMENT DU STRONTIUM 90 DANS LE SOL ET LA PLANTE. MESURES AGRICOLES EN VUE DE DIMINUER LA CONTAMINATION DES PRODUITS ALIMENTAIRES. (Behavior of Strontium-90 in Soil and Plants. Agricultural Methods for Lowering Contamination of Food Products). F. Scheffer and F. Ludwig. Translated into French from Atompraxis 4, 416-19(1958). 15p.  
This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 4408.
- 884**  
INFLUENCE OF LIGHT ON  $P_2O_5$  UPTAKE BY SEEDLINGS. F. Scheffer, A. Kloeke, and H. Folster. (Univ. Göttingen, Ger.). Plant and Soil 8, 194-8(1957)(in German). CA-52: 16483f.
- 885** A/CONF.15/P/989  
USE OF  $^{32}P$  FOR INVESTIGATIONS IN THE SYSTEM SOIL-SOIL SOLUTION-PLANT. F. Scheffer and B. Ulrich (Univ. of Göttingen, Ger.). 8p.  
The use of  $P^{32}$  in pot experiments allows the calculation of the amount of nutrient in the plant, coming from the fertilizer, the percentage of the fertilizer taken up by the plant, the isotopic exchangeable soil phosphorus, and the percentage of water insoluble fertilizer which has reacted with the soil solution. Examples are discussed. The validity of isotope dilution equation in pot experiments is discussed, partly in connection with reversible phosphorus exchange between plant and soil and nutrient solution. Kinetic studies are described on determination of isotopic exchangeable soil phosphorus in three or more reactions, which are characterized by the reaction half-time and the amount of phosphorus involved. The processes responsible for the availability of nutrients in soil are discussed briefly.
- 886**  
ZINC UPTAKE IN ALFALFA. W. G. Schrenk, Delbert A. Naumann, and R. E. Hein. (Kansas Agr. Expt. Sta., Manhattan). Trans. Kansas Acad. Sci. 50, 71-7(1957). CA-52: 20441h.
- 887** (TID-15982) CARBON-14 FIXATION IN POLLEN OF YELLOW LUPINE (LUPINUS LUTEUS LINN.). William G. Schwen, John C. Frazier, Herbert C. Moser, and James A. Gess (Kansas. Agricultural Experiment Station, Manhattan). [nd]. Contract AT(11-1)-1015. 12p.  
Carbon-14 fixation studies were made on germinated pollen of yellow lupine to ascertain whether the chlorophyll reported to be in these grains was functional photosynthetically. Light and dark exposures to atmospheres containing 20 and 500  $\mu c$  of carbon-14 labeled carbon dioxide were made for 1.5 and 45 minutes, respectively. The exposed pollen was extracted in 80% ethanol, the resulting extract reduced in volume, and chromatographed two dimensionally. When the chromatograms were cut into numbered small squares and their activity counted in an automatic sample counting system, a marked similarity was observed in the pattern of radioactivity from all exposures. Eluting and co-chromatographing this activity from the squares, with known standards, demonstrated labeling to be specific to certain intermediates of the Krebs cycle and their derived amine acids. The labeling in these intermediates and the absence of labeling in photosynthetic metabolites is strong evidence that only respiratory fixation of carbon-14 occurs in the germinated pollen of this variety of yellow lupine under the conditions of the experiment.
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MALONATE METABOLISM OF PLANT TISSUES. Leland M. Shannon, Roger H. Young, and Carlton Dudley (Univ. of California, Los Angeles). Nature 183, 683-4(1959). CA 53-16288b
- 889**  
THE REACTION OF PLANTS TO THE RADIATION EFFECT OF  $S^{35}$  IN THE FIRST AND SECOND GENERATIONS. A. G. Shestakov, G. F. Ivanova, and N. I. Shmel'kova. Izvest. Timiryazev. Sel'skokhoz. Akad. 4, 29-40(1958). CA-52: 20417g.
- 890**  
RANDOMIZATION OF THE CARBON ATOMS IN GLUCOSE AND FRUCTOSE DURING THEIR METABOLISM IN BARLEY SEEDLINGS. S. Shibko and J. Edelman. (Imp. Coll., London). Biochim. et Biophys. Acta 25, 642-4(1957)(In English). CA-52-1376h.
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ALANINE IN PLANT METABOLISM. E. A. Shilov and A. A. Yasnikov (Inst. Org. Chem., Acad. Sci. Ukr. S.S.R., Kiev). Doklady Akad. Nauk S.S.S.R. 124, 459-61(1959). CA 53-9378f
- 892**  
THE EFFECT OF BORON ON THE RATE OF INCORPORATION OF  $P^{32}$  BY THE NUCLEIC ACIDS OF THE SUNFLOWER. M. Ya. Shkol'nik and A. V. Kositsyn (V. L. Komarov Botanical Inst., USSR). Doklady Akad. Nauk S.S.S.R., 144: 662-4(May 21, 1962). (In Russian)  
Six sunflower plants were grown from seed in a vessel 1.8 liters in volume on a Knop solution with and without boron. In 9 to 14 days the plants were transferred to a Knop solution of the same composition, containing phosphate tagged with  $P^{32}$  (10 to 40  $\mu c$  of  $P^{32}$  tracer per vessel). Analyses of RNA and DNA were then made in 2 to 4 days on the roots, stems, cotyledons and upper leaves of the plants. The specific activities of the  $P^{32}$  in the nucleic acid fractions were determined. The analyses show that a

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boron deficiency slows down the synthesis of nucleic acids, especially in the parts of the plant where the growth of new tissue is intensive. The specific activity of the  $P^{32}$  in the nucleic acid fractions is about a factor of 10 higher when boron is fed to the plant. The results show that boron plays an important role in the synthesis of the nucleic acids.

893

RATIO BETWEEN BIOSYNTHESIS OF CHLOROPHYLL A AND CHLOROPHYLL B IN THE PROCESS OF RENEWAL METABOLISM. A. A. Shlyk, T. N. Godnev, R. M. Rotfarb, and Ya. P. Lyakhovich. *Byull. Inst. Biol., Akad. Beloruss. S.S.R.* 1956, No. 2, 59-64 (Pub. 1957). CA-52: 20438e.

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RENEWAL OF CHLOROPHYLL COMPONENTS IN THE PROCESS OF ACCUMULATION. A. A. Shlyk, T. N. Godnev, Ya. P. Lyakhovich, R. M. Rotfarb, and V. I. Yunevich. *Byull. Inst. Biol. Akad. Nauk Beloruss S.S.R.* 1956, No. 2, 64-71 (1957). CA-53: 1474d.

895 A/CONF.15/P/980

THE UPTAKE OF ZINC AND STRONTIUM IN VITIS VINIFERA. O. Siegel and W. Goerke (Pflanz. Landw. Untersuchungs- und Forschungsanstalt Speyer/Rhein). 11p.

Data are reported from a study of zinc-65 uptake by grape vines. A method is described for measuring the rate of intake of trace amounts of chemicals by plants. It is suggested that the method may also be used for measuring the rate of deposition of fall-out on plant surfaces.

896 THE INTRODUCTION OF TRITIUM IN SOME SUGARS DURING PHOTOSYNTHESIS. H. Simon and A. Trebst (Technische Hochschule, Munich). *Z. Naturforsch.*, 16b: 285-7 (Apr. 1961). (In German).

A study was made on chloroplasts and chlorella to determine how much T was bound during photosynthesis per  $C^{14}O_2$  fixed. The sugar phosphate isolated and identified through paper chromatography and autoradiography were dephosphorylated, and the free sugar was rechromatographed and eluted. The tritium and  $C^{14}$  were determined. The  $C^{14}/T$  ratio found in the sugars was compared with the  $C^{14}/T$  ratio in the bicarbonate- $C^{14}$  and HOT used. The results are tabulated for various sugars. The  $C^{14}/T$  ratio in the photosynthetic products is smaller than in the substrate. This indicates an enrichment in tritium. In chlorella only half as much T is bound as in chloroplasts.

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ON THE SYNTHESIS OF TRITIUM IN SOME SUGARS IN PHOTOSYNTHESIS. H. Simon and A. Trebst. *Z. Naturforsch.* 16B, 285-7 (1961) Apr.

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PHOTODEPENDENT PHOSPHORYLATION. VII. THE EFFECT OF MONOIODOACETIC ACID ON THE FORMATION OF PHOSPHORUS-32-MARKED PHOSPHORYLATED COMPOUNDS IN ELODEA DENSA (PHOSPHOGLYCERIC ACID AN INTERMEDIATE PRODUCT OF PHOTOSYNTHESIS?). W. Simonis and G. Weichart (Tierärztlichen Hochschule, Hannover, Ger.). *Z. Naturforsch.* 13b, 694-6 (1958). CA 53-93671

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PHOSPHORYLATION DEPENDENT ON LIGHT. V. THE METHODOLOGICAL QUESTIONS ON THE EXTRACTION AND PAPER CHROMATOGRAPHY OF PHOSPHORUS-32-LABELED COMPOUNDS FROM ALGAE. Wilhelm Simonis, Horst Kating, and Gunter Kues. (Tierärztliche Hochschule, Hannover, Ger.). *Z. Naturforsch.* 12b, 812-13 (1957). CA-52: 14749h.

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QUANTITATIVE DETERMINATION OF THE FORMATION OF PHOSPHORUS-32-LABELED PHOSPHORYLATED COMPOUNDS IN ELODEA. W. Simonis and G. Weichart. (Botan. Inst., Hannover, Ger.). *Z. Naturforsch.* 13b, 55-7 (1958). CA-52: 8296d.

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A COBALT MACHINE FOR SEMI-ACUTE IRRADIATION OF GROWING PLANTS. W. R. Singleton, A. Caspar, and W. S. Flory, Jr. (Univ. of Virginia, Boyce). *Intern. J. Appl. Radiation and Isotopes*, 10: 47-54 (Feb. 1961). (In English)

A  $Co^{60}$  machine for irradiating growing plants with gamma rays is described. The 200-c machine is shielded behind earthen bunkers with concrete retaining walls, also a sky-shine shield intercepts vertical radiation. The radiation level at the control house, 100 ft away, is 2 mr/hr. The source is held in place by an electromagnet which is raised and lowered by a windlass in the control house by means of a stainless-steel cable. In case of power failure the  $Co^{60}$  source drops into the lead container in the center of the field. Either seeds, plants, or other biological specimens may be treated. Doses ranging from 7000 r/hr at 20 cm to 1 r/hr at 20 m may be used. At 1 m the dose is 310 r/hr or approximately 7300 r for a 23.5 hr day. A dose of 1000 r is sufficient for inducing many mutations in plant material. This can be obtained in 23.5 hr at about 3 m from the source.

902

THE SYNTHESIS OF NUCLEIC ACIDS AND PROTEINS IN THE NUCLEI OF TRADESCANTIA ROOT TIPS. Jesse E. Siskin. (Med. Research Inst., Duarte, Calif.). *Proc. Intern. Congr. Genetics*, 10th, Montreal, 1958, 2, 262 (1958). CA-52: 20458c.

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THE  $Sr^{90}$  CONTENT OF DIFFERENT GRASSLAND SAMPLES IN THE FEDERAL DISTRICT IN RELATION TO  $Sr^{90}$  CONTENT OF THE SOIL. Albert Sittkus (Universität, Freiburg i. B.) and Erwin Welte (Landwirtschaftliche Forschungsanstalt Buntshof, Hanover). *Naturwissenschaften* 46, 399-400 (1959) (In German)

The  $Sr^{90}$  content of plant materials was determined and compared to  $Sr^{90}$  content of the soils from which they were taken. Plotting plant  $Sr^{90}$  on the y-axis and soil  $Sr^{90}$  on the x-axis gives a straight line:  $y = 0.173x + 0.70$ .

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FIXATION OF CARBON DIOXIDE- $C^{14}$  INTO TARTARIC AND MALIC ACIDS OF EXCISED GRAPE LEAVES. Helen A. Stafford and Frank A. Loewus. (Reed Coll., Portland, Oregon). *Plant Physiol.* 33, 194-9 (1958). CA-52: 14772i.

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- 906**  
A STUDY OF MICROAUTORADIOGRAPHY OF THE DISTRIBUTION OF TRITIUM-LABELED GLYCINE IN RUSTED PINTO BEAN LEAVES. Richard C. Staples and Myron C. Ledbetter. *Contribs. Boyce Thompson Inst.* 19, 349-54(1958). CA-52: 20445b.
- 907** THE EFFECT OF TRITIATED THYMIDINE ON THE MORPHOGENESIS OF LATERAL ROOTS. O. L. Stein (Montana State Univ., Missoula) and H. Quastler. p.149-53 of "Tritium in the Physical and Biological Sciences. Vol. II." Vienna, International Energy Agency, 1962. (BNL-5333). (In English)  
Along the axis of a primary root exists a series of successive developmental stages of the same organ—the lateral root, a system ideal for assaying effects of various agents on organogenesis. Primary roots of several species grown in  $H^3$ -thymidine in various concentrations and for different periods of time show a region devoid of lateral roots which corresponds closely to the region of differentiation at time of treatment. Anatomical analysis combined with autoradiography indicates that "hot" pericycle cells may be capable of 1 or 2 cell divisions before further development of the lateral root is inhibited. There is evidence that a minimum number of cells must be affected before substitution by adjacent cells is eliminated. This may be a function of the length of the cell division cycle and thus prescribe the duration of treatment for the desired morphological effect. Root primordia already established at time of treatment do not appear affected if the amount of radioactivity is chosen discriminately. In *Zea mays* the effect of "nuclear irradiation" on differentiation was compared with the effect of x rays and gamma irradiation ( $Co^{60}$ ). In general, the external irradiation results in a more diffuse disturbance of both lateral and primary root growth. When duration of exposure and dose of an external source are properly chosen the internal effect of tritiated thymidine can be approached. The system offers opportunity to discriminate between damage due to nuclear irradiation (genetic effects?) and general irradiation (genetic + physiological?). *Pisum sativum* and *Cucumis sativus* were also used. Current work involves autoradiography to determine the amount of chromosomal radiation needed to disturb these developmental processes.
- 908** (BNL-6570) THE EFFECTS OF CHRONIC GAMMA IRRADIATION ON THE GROWTH OF *KALANCHOE* cv. "BRILLIANT STAR." O. L. Stein and A. H. Sparrow (Montana State Univ., Missoula and Brookhaven National Lab., Upton, N. Y.). [1962]. Contract [AT(30-2)-gen-16]. 51p.  
*Kalanchoe* seedlings were exposed to 330 r/20 hr/day from a  $Co^{60}$  source. Samples were harvested weekly. No new leaves were produced after initial exposure to irradiation. Mitosis in the apical meristem appears to have been suppressed. However, the axillary meristems and the cambium continue their activity. This results in a much broadened stem tip with enlarged cells, supported by a stout internode in which cell size has remained relatively normal but cell number has increased. After about 26 days of exposure, meristematic activity in the shoot apex region appears to resume. This results in the formation of growth centers which can give rise to leaves or malformed structures. The original phyllotaxy is not recovered. It is suggested that this resumption of growth may be an instance of adaptation to irradiation. In a second investigation the effect of chronic irradiation at various dose rates and on plants of different ages was tested. The dose rates used were 10, 25, 50, 100, and 250 r/20 hr/day. Plants were in leaf stage 6, 8, 11, and 16 at the beginning of the experiment. No obvious age effect could be determined over this range of leaf stages. At 10 and 25 r/day rate of leaf production does not appear to be affected. At 50 r/day about 5 more leaf pairs are formed before normal activity of the apical meristem ceases. In heavily irradiated plants leaves tended to be larger, broader, and heavier. Much of this is the result of more cells rather than larger cells. Internodes which are formed during irradiation show a reduction in length, largely because fewer cells are formed. The degree of reduction is dose dependent.
- 909**  
NITROGEN METABOLISM; RESPIRATION, AND GROWTH OF CULTURED PLANT TISSUE. IV. THE IMPACT OF GROWTH ON PROTEIN METABOLISM AND RESPIRATION OF CARROT TISSUE EXPLANTS. GENERAL DISCUSSION OF RESULTS. F. C. Steward (Cornell Univ., Ithaca, N.Y.) and R. G. S. Bidwell. *J. Exptl. Botany* 9, 285-305(1958). CA 53-11529i
- 910** (HW-69500(p.92-6)) EFFECT OF SOIL MOISTURE ON UPTAKE AND TRANSLOCATION OF CESIUM-137 AND POTASSIUM IN BEAN PLANTS. J. D. Stewart (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).  
Increasing soil moisture tension increased plant uptake of  $Cs^{137}$  to a greater extent than K. Ratio of  $Cs^{137}$  to K showed values as high as four for some plant tissue. The addition of carrier Cs and NPK to the soil did not significantly alter the effect of soil moisture tension on  $Cs^{137}$  and K uptake.
- 911** (HW-65500(p.37-41)) INFLUENCE OF SOIL MOISTURE ON ION UPTAKE BY BEAN PLANTS. J. D. Stewart. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.  
Variation in available soil water did not influence plant uptake of  $Ca^{45}$  and  $Sr^{85}$  but were found to influence  $Cs^{137}$  and potassium uptake. Cesium-137 uptake was increased to a greater extent than potassium at the lower moisture levels. Both potassium and  $Cs^{137}$  were concentrated more in stems than in leaves as available soil moisture decreased, suggesting reduced translocation to the leaves or translocation from the leaves to the stems.
- 912** TID-7554(p.487-503)  
California. Univ., Berkeley. Kearney Foundation of Soil Science.  
USE OF RADIOISOTOPES IN PLANT NUTRITION STUDIES. P. R. Stout and T. C. Broyer. p.487-503 [of] PROCEEDINGS OF THE INTER-AMERICAN SYMPOSIUM ON THE PEACEFUL APPLICATION OF NU-

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CLEAR ENERGY, BROOKHAVEN NATIONAL LABORATORY, MAY 13-17, 1957. 17p.

Applications of radioisotopes in research on plant nutrition are reviewed. Related subjects such as soil chemistry, entomology, plant pathology, genetics, and plant physiology are also discussed.

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CHOROPLAST PIGMENTS OF DEUTERATED GREEN ALGAE. H. H. Strain, H. L. Crespi, and J. J. Katz. *Nature (Lond)* **184** (Suppl. 10) 730-1 (1959) Aug. 29?

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CHLOROPLAST PIGMENTS AND PHOTOSYNTHESIS IN DEUTERATED GREEN ALGAE. H. H. Strain, M. R. Thomas, H. L. Crespi, M. I. Blake, and J. J. Katz (Argonne National Lab., Ill.). *Ann. N. Y. Acad. Sci.*, **84**: 617-33 (Nov. 25, 1960).

The isolation and characterization of deuterio-chlorophylls *a* and *b* from the chloroplasts of fully deuterated green algae, together with some preliminary observations on photosynthesis in deuterated algae, are described. An improved procedure is given for the isolation and purification of the chlorophylls. The algae used in the study were cultured for more than a year in a nutrient solution prepared from 99.8% D<sub>2</sub>O. The infrared studies reported provide independent evidence that the chlorophyll made by the algae is essentially free of hydrogen. The ratio of deuterio-chlorophyll *a* to *b* in crude extracts of the deuterated algae was determined to be in the range 1.5:1 to 2:1. The uptake of NaHC<sup>14</sup>O<sub>3</sub> by ordinary and deuterated *C. vulgaris* in H<sub>2</sub>O and D<sub>2</sub>O were measured, and the results are tabulated.

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DEUTERIOCAROTENOID PIGMENTS FROM FULLY DEUTERATED GREEN ALGAE. H. H. Strain, M. R. Thomas, H. L. Crespi, and J. J. Katz. *Biochim. Biophys. Acta* **52**, 517-26 (1961) Sept.

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ASSIMILATION OF NITROGEN-15 FROM LABELED HYPONITRITE BY SOYBEAN LEAVES. D. Stuart Frear and R. C. Burrell. (Ohio State Univ., Columbus). *Plant Physiol.* **33**, 105-9 (1958). CA-52: 10301e.

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THE EFFECT OF pH ON THE ABSORPTION OF Sr<sup>89</sup>, P<sup>32</sup>, AND Fe<sup>59</sup> IONS BY LEAVES OF *ZEAMAYS*. T. W. Sudia and A. J. Linck (Univ. of Minnesota, St. Paul). *Ohio J. Sci.*, **61**: 107-12 (Mar. 1961).

The absorption and translocation of phosphorus-32, iron-59, and strontium-89 by the leaves of 10-day-old corn plants were studied as functions of pH. The pH of the solution in which the mineral ion is supplied to the corn plants had a significant effect on absorption. For the three mineral ions studied, greater absorption occurred at the lower pH values of 2.5 and 4.5 and significantly lower amounts were absorbed at the higher pH values of 7.0 and 8.2. All three mineral ions are readily absorbed by the leaves of corn but they differ markedly in the amount of each ion transported from the leaves. For the isotope of phosphorus, between 10 and 18% of the total activity in the plant is found in the stem and leaves following transport from the applied leaf. These figures can be compared to from 45 to 67% of the iron translocated. Less than 2% of the radiostrontium was transported from the applied leaf

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FERMENTATION OF GLUCOSE BY *CHLORELLA VULGARIS*. P. J. Syrett (Univ. Coll., London). *Nature* **182**, 1734-5 (1958). CA 53-11501i

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UTILIZATION OF UNIFORMLY LABELED C<sup>14</sup>-GALACTOSE BY ETIOLATED AVENA COLEOPTILES. Kenneth V. Thimann, J. Craigie, G. Krotkov, and Lillian Cowie. (Harvard Univ.). *Am. J. Botany* **45**, 295-7 (1958). CA-52: 13027d.

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ON THE EFFECT OF ETHYLENEDIAMINETETRAACETATE (EDTA) ON THE ACCUMULATION COEFFICIENT OF DIFFERENT RADIOISOTOPES FROM AQUEOUS SOLUTION BY FRESH-WATER PLANTS. E. A. Timofeeva-Resovskaya, and N. V. Timofeev-Resovskii (Inst. of Biology, Urals Div., Academy of Sciences, USSR). *Doklady Akad. Nauk S.S.S.R.* **130**, 210-13 (1960) Jan. 1. (In Russian)

The effects of ethylenediaminetetraacetate on the accumulation coefficients of Ce<sup>144</sup>, Co<sup>60</sup>, Cs<sup>137</sup>, Fe<sup>59</sup>, Nb<sup>95</sup>, Ru<sup>106</sup>, S<sup>35</sup>, Sr<sup>90</sup>, Y<sup>91</sup>, Zn<sup>65</sup>, and Zr<sup>95</sup> from aqueous solutions were studied. Eight grams of elodea (*Elodea canadensis* Rich.), aquatic plant (*Ceratophyllum demersum* L.), duckweed (*Lemna minor* L.), and chara (*Chara fragilis* Desw.) were placed in three liters of water containing 400 mg of EDTA per liter. Tabulated data show 4 groups of isotopic reactions to EDTA. The first group includes strontium and cesium (whose uptake increases in the presence of EDTA), the second is represented by sulfur (which does not react to EDTA), the third group consists of zirconium, niobium, and ruthenium (whose uptake is reduced 2 to 3 fold in the presence of EDTA), and the fourth group contains iron, cobalt, zinc, yttrium, and cerium (whose uptake is reduced 10 to 100 fold).

921

SOME EFFECTS OF GAMMA-IRRADIATION ON BARLEY AND ITS MALTING PROPERTIES. K. H. Tipples and F. W. Norris (Univ. of Birmingham, Eng.). *J. Sci. Food Agr.*, **14**: 646-54 (Sept. 1963).

Irradiation of barley above and below disinfestation levels (16,000 rads) was carried out to study the effects of irradiation and post-irradiation storage on malting properties. Maltose figures and free  $\beta$ -amylase of raw barley increased at low irradiation levels. Respiration rate and rootlet production decreased slightly with increasing irradiation, while malts produced from barley irradiated below 100,000 rads showed little change in  $\alpha$ - and  $\beta$ -amylase and in proteinase activities. The effects on micro- and pilot-scale malted barley were sometimes in sharp contrast. Growth of barley seedlings demonstrated that unevenness caused by irradiation was more marked in the plumules than in the roots. Plant height, but not root length, showed the reversal effect. Standard analyses of pilot-scale malts indicated a slight degree of undermodification after irradiation. Technological implications of the irradiation process for disinfestation are discussed.

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ON CONDITIONS OF DETECTION OF HIDDEN DEFECTS IN THE STRUCTURE OF DNA IN SEED FOLLOWING GAMMA IRRADIATION. V. I. Tokarskaia. *Radiobiologia* **2**, 161-5 (1962)

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METABOLISM OF ACETATE-1-C<sup>14</sup> ENTERING THE PLANT VIA THE ROOT SYSTEM. V. I. Tokarskaya



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ON THE CAUSE OF ASYMMETRICAL C<sup>14</sup> DISTRIBUTION IN HEXOSE DURING PHOTOSYNTHESIS WITH CHLOROPLASTS. A. Trebst and F. Fiedler. *Z. Naturforsch* 17B, 553-8(1962) Aug.

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SEPARATION OF LIGHT AND DARK PHASES IN PHOTOSYNTHESIS OF ISOLATED CHLOROPLASTS. Achim V. Trebst, Harry Y. Tsujimoto, and Daniel I. Arnon. (Univ. of California, Berkeley). *Nature* 182, 351-5(1958). CA-53: 3385f.

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BIOLOGICAL ACTION OF NEUTRONS ON PLANTS. S. F. Tselischev and V. B. Mogilevkin. *Izvest. Timiryazev. Sel'skokhoz. Akad.* 1957, No. 3, 33-51. CA-52: 7439e.

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UTILIZATION OF NITROGEN-15 FOR INVESTIGATION OF PLANT METABOLISM IN RELATION TO AGE OF THE PLANT, TIME OF INTRODUCTION OF FERTILIZERS, AND THEIR DOSES. V. V. Tserling, G. M. Shcheglova, E. G. Plyshevskaya, and V. V. Zertsalov. (V. V. Dokuchaev Soil Inst., Acad. Sci. U.S.S.R., Moscow). *Fiziol. Rastenii* 4, 3-13(1957). CA-52: 12095c.

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BIOCHEMICAL STUDIES ON TOBACCO ALKALOIDS. I. FATE OF LABELED TOBACCO ALKALOIDS SUPPLIED TO NICOTIANA PLANTS. T. C. Tso and R. N. Jeffrey (Univ. of Maryland, College Park). *Arch. Biochem. Biophys.* 80, 46-56(1959). CA 53-11537g

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NITROGEN EXCHANGE IN PLANTS, USING NITROGEN-15. F. V. Turchin, M. A. Guminskaya, and E. G. Plyshevskaya (Ya. V. Samoilov Sci. Research Inst. Fertilizers and Insectofungicides, Moscow). U.S. At. Energy Comm. AEC-tr-3376, 65-80(1957). CA 53-9374i

931 (ANL-6464(p.116-27)) INCORPORATION OF 2-C<sup>14</sup>-GLUTAMIC ACID INTO PEPTIDES AND PROTEINS OF CELL-FREE HOMOGENATES OF PEA SEEDS. James E. Turner (Argonne National Lab., Ill.).

Pea seeds contain ninhydrin-positive material that yields amino acids following hydrolysis with hydrochloric acid. In cell-free homogenates of pea seeds more glutamic acid is incorporated into this material during the first hour of incubation than into the bulk protein fraction. It is not possible at present to state whether this peptide material is subsequently incorporated into protein; however, the data are consistent with the hypothesis that peptides serve as intermediates in protein synthesis in pea seeds.

932

THE INFLUENCE OF SEED STORAGE ON THE TERMINAL EFFECT OF GAMMA IRRADIATION (Co<sup>60</sup>). M. M. Tushnyakova. *Tr. Inst. Genet., Akad. Nauk SSSR*, No. 29, 185-93(1962).

Seeds of two varieties of oats, *Avena sativa* and *A. nuda*, were treated with x-ray doses ranging from 15000 to 30000 r. In the case of *A. nuda*, seed of the previous harvest and seed stored for 5 years were used but only fresh seed of *A. sativa* was treated. One portion of the 5-year old *A. nuda* was irradiated on April 7, 1958, and sown 4 weeks later together with control non-irradiated seed. The 15 kr dose slightly reduced germination and survival and induced morphological and physiological variability. Although the seeds set, their yield was markedly lower than in the controls. The effects were augmented when higher doses were applied. Germination was reduced by approximately 10% for each 5 kr increment in dose. In contrast, the reduction in survival with increasing dose displayed geometric progression, falling from 80% at 15 kr to 27.55 at 20 kr and 0.5% at 25 kr. The control material showed 90.5% germination and 99.4% survival. A similar pattern was observed when fresh *A. nuda* seed of the previous harvest was irradiated and then stored for two years. Subsequent sowing tests showed that the germination and survival capacity of the material gradually decreased during storage, particularly when higher dosage rates were used. Similar results were obtained with *A. sativa* seed. Thus when seed was exposed to 25 kr and stored for 14 months, survival capacity was nil, except when gibberellic acid or various other chemicals were used to treat seed after irradiation, in which case 1-3% survival was noted.

933

(HW-65500(p.42-8)) INSOLUBILITY AS A FACTOR IN Sr<sup>90</sup> AVAILABILITY TO PLANTS. R. L. Uhler. General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

The uptake of Sr<sup>90</sup> from compounds of varying solubility which were mixed in soils was followed over an extended period. Differences in uptake suggests that Sr<sup>90</sup> in the presence of phosphate and calcium carbonate are fixed in the formation of hydroxyapatite. Massive applications of phosphate to a calcareous soil contaminated with soluble Sr<sup>90</sup> reduced Sr<sup>90</sup> uptake and supports hydroxyapatite fixation of Sr<sup>90</sup>.

934

(HW-69500(p.103-7)) MECHANISM OF CALCIUM-STRONTIUM DISCRIMINATION IN PLANTS. R. L. Uhler, O. Biddulph, and F. P. Hungate (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.).

Bean plants were grown in nutrient solution to which Ca<sup>45</sup> and Sr<sup>85</sup> were added. Relative concentrations of these isotopes in different plant parts were observed to change with time. The more rapid initial movement of Sr<sup>85</sup>, compared to Ca<sup>45</sup>, to leaves was assumed to be due to Ca<sup>45</sup> exchange with stable calcium pre-existing in stems and roots.

935

HW-59500(p.33-40) General Electric Co. Hanford Atomic Products Operation, Richland, Wash. INFLUENCE OF CALCIUM ON Sr<sup>90</sup> UPTAKE. R. L. Uhler. 8p.

Available calcium was the most significant factor studied which reduced uptake by plants of radiostrontium from soil. Time to equilibrate insoluble and soluble forms of strontium in soil was found to be long. Slight

## REFERENCES

differences in relative concentrations of  $\text{Sr}^{85}$  and  $\text{Ca}^{45}$  were noted in different plant parts.

936

EFFECT OF VARIOUS TYPES OF NITROGEN ON THE PRODUCTS OF ASSIMILATION OF LEAVES AND THEIR DISTRIBUTION BETWEEN EPIGEAL AND ROOT ORGANS IN CORN. S. G. Vaklinova, N. G. Doman, and B. A. Rubin (Inst. Plant Growing, Bulgarian Acad. Sci., Sofia). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 5, 516-23(1958). CA 53-8502e

937

CONTRIBUTION TO THE STUDY OF SOLANACEAE. THE BIOSYNTHESIS OF THE ALKALOIDS OF DATURA TATULA VAR. INERMIS. R. van Severen. *J. pharm. Belg.* 14, 36-44(1959). CA 53-17424a

938

STUDY OF CHEMISTRY OF BIOLOGICAL OXIDATION IN PLANTS WITH APPLICATION OF OXYGEN-18. B. B. Vartapetyan. *Problemy Kinetiki i Kataliza, Akad. Nauk S.S.S.R., Inst. Fiz. Khim., Soveshchanie, Moscow*, 1956, 9, 124-8(1957). CA 53-8328f

939

A HYGIENIC STUDY OF GRAIN IRRADIATED WITH RADIOACTIVE COBALT. E. N. Vasil'ev, L. A. Okuneva, and Iu. P. Kukel. *Vop. Pitan.* 19, (1961) Sept.-Oct.

940

EFFECTS OF RADIOPHOSPHORUS ON RYE PLANTS. Matilde Martinez Vazquez and Francisco M. Sarasola Sancho. *Bol. del inst. nacl. invest. agron. (Madrid)*, 20: No. 43, 287-309(Dec. 1960). (In Spanish)

The effects of  $\text{P}^{32}$  on rye plants have produced in their descendants ( $\text{F}_2$ ) the following anomalies: minor vegetative development in the plant in all their stages, but major precocity; kernels not well appointed, but of interesting proteic value; ears very ramified, with more kernels than the normal rye, but with little fertility taking into consideration the big number of spikelets caused by their ramification; minor germinative faculty that the normal rye, very apparent in the country; a big inhibition in the development of the first lateral roots pairs; total inhibition in the development of the roots, belonging to the two lateral pairs placed nearest to the hypocotyl region; embryos with light of full torsion scutellum and coleoptyl can have origine for effect of the pressure suffered in the ovary since the space with which the fecundate ovules counts in the development will be reduced by the big density of the spikelets and so of flowers which show in the stalks secondary, tertiary etc. of the ramified ears; twin embryos with free, coleoptyls and embryos with double hypocotyl buds wrapped with one coleoptyl; big abnormality in the arrangement of the vascular system in the hypocotyl region of certain embryos, in order to determine it, in the scutellum vessels through coleoptyl, in embryos which show all their organs perfectly normal, without any deformation or torsion. These two anomalies lastly mentioned will be able to attribute to genetic causes; a big recuperation can be confirmed of the cells and almost the disappearance of the anomalies found in mitosis in plants with treatments; and in meiosis it has followed some citological alterations like the apparition of anafasic bridges, later chromosomes and supernumeraries, but in very little number.

941

UPTAKE AND TRANSLOCATION OF IRON 59 IN PHASEOLUS VULGARIS L. Leopoldo Villegas (Instituto Venezolano de Investigaciones Cientificas, Caracas). p.179-82 of "Radioisotopes and Radiation in the Life Sciences. 2nd Inter-American Symposium on the Peaceful Application of Nuclear Energy, Buenos Aires, 1959."

A study was made of the active uptake of iron at different stages of growth in black bean plants in relation to the rate of live weight increase. Weight increase and absorption values remained constant during vegetative growth and increased with maturation, with flower and fruit development. But the relationship between the two remained constant. This constant relationship suggests also a constant level of accumulation. The irreversibility of the process of active absorption was proved. A study was made of the retranslocation at different stages of growth, with affirmative results, although this process slows down as the plant matures.

942

ELECTRON TRANSPORT IN PHOTOSYNTHESIS. Wolf Vishniac (Yale Univ.). U.S. At. Energy Comm. BNL-512(C-28), 54-64(1958)(Pub. 1959). CA 53-20288g

943

THE INFLUENCE OF  $\beta$ -PARTICLES OF RADIOACTIVE ISOTOPES ON SIZE VARIATION IN CHLOROPLASTS OF ELODEA CANADENSIS. P. A. Vlassyuk and M. I. Bidzilya (Ukrainian Research Inst. of Plant Physiology). *Doklady Akad. Nauk S.S.S.R.* 119, 65-7(1958) Mar. 1. (In Russian)

Effects of  $\beta$  particles from  $\text{S}^{35}$ ,  $\text{Ca}^{45}$ ,  $\text{W}^{185}$ , and  $\text{P}^{32}$  on the size changes of chloroplasts in *Elodea canadensis* cells were studied. There are indications that small doses of  $\beta$  particles increase the *Elodea* chloroplasts.

944

LYSINE BIOSYNTHESIS IN CHLORELLA AND EUGLENA: PHYLOGENETIC SIGNIFICANCE. Henry J. Vogel (Rutgers Univ., New Brunswick, N.J.). *Biochim. et Biophys. Acta* 34, 282-3(1959)(in English). CA 53-19038f

945

ABSORPTION OF CARBON DIOXIDE BY PLANT-ROOTS. V. L. Voznesenskii. (V. L. Komarov Botan. Inst., Acad. Sci. U.S.S.R., Leningrad). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 5, 329-36(1958). CA-52: 20443g.

946

PHYSIOLOGICAL STUDIES ON ACID METABOLISM IN GREEN PLANTS. VI. TRANSAMINASES IN CELL-FREE EXTRACTS FROM KALANCHOE LEAVES. D. A. Walker and S. L. Ranson. (King's Coll., Newcastle-upon-Tyne, Engl.). *Plant Physiol.* 32, 226-30(1958). CA-52: 14773h.

947

PHOSPHORUS AND BICARBONATE EFFECTS ON  $\text{Sr}^{85}$  ACCUMULATION BY BUSH BEANS. Arthur Wallace (Univ. of California, Los Angeles). *Soil Sci. Soc. Am. Proc.* 24, 327-8(1960) July-Aug.

Several exploratory studies were made of possible phosphorus and bicarbonate effects on the accumulation of  $\text{Sr}^{85}$  by bush beans. Without added bicarbonate, increasing

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the phosphorus increased the content of  $\text{Sr}^{90}$  in roots but had little effect on that in the tops. With a  $10^{-2}\text{M}$  bicarbonate level, increasing the phosphorus resulted in a progressive decrease of  $\text{Sr}^{85}$  in both roots and tops. In the absence of phosphorus from the nutrient solution, the content of  $\text{Sr}^{85}$  in the roots increased markedly with the concentration of bicarbonate.

948

INFLUENCE OF PETROLEUM OIL ON THE TRANSLOCATION OF PHOSPHORUS IN SMALL LEMON PLANTS. Randolph T. Wedding and Louis A. Riehl. (Univ. of California, Riverside). *Am. J. Botany* 45, 138-42(1958). CA-52: 12108c.

949

SIMPLE METHOD FOR DETERMINING STRONTIUM-90 IN PLANT MATERIAL. E. Welte and U. Marckwordt (Landwirtschaftliche, Forschungsanstalt Buntehof, Hanover). *Atompraxis* 6, 228-9(1960) June. (In German)  
A method for quantitative determination of  $\text{Sr}^{90}$  in plant material is described. In the course of analysis the substance was charred and the ash dissolved. Phosphate ions and hydroxides were separated from the solution. The alkaline earths were removed in the form of carbonates. From the radiochemical equilibrium between strontium and yttrium, yttrium was isolated and measured. No inactive strontium carrier was added. The calcium content of the sample served as a carrier for the strontium. The chemical yield was determined by adding  $\text{Sr}^{89}$ .

950

SENESCENCE OF ROSES. II. DARK FIXATION OF CARBON DIOXIDE BY CUT BETTER TIMES ROSES AT DIFFERENT STAGES OF SENESCENCE. Leonard H. Weinstein and Henry J. Laurencot, Jr. *Contribs. Boyce Thompson Inst.* 19, 327-40 (1958). CA-52: 20444h.

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CONCENTRATION OF CESIUM-137 BY ALGAE. Louis G. Williams and H. D. Swanson. (Furman Univ., Greenville, S. C.). *Science* 127, 187-8(1958). CA-52: 12102g.

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THE UPTAKE AND DISTRIBUTION OF RADIOACTIVE PHOSPHORUS ( $\text{P}^{32}$ ) IN RELATION TO THE MUTATION RATE IN PLANTS. Watkin Williams and G. J. Dowrick. (John Innes Horticultural Inst., Bayfordbury, Engl.). *J. Hort. Sci.* 33, 80-95 (1958). CA-52: 13878e.

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ASSIMILATION OF UREA ABSORBED THROUGH PLANT LEAVES. EXPERIMENTS USING UREA- $\text{N}^{15}$ . Michihiko Yatazawa (Univ. Nagoya). *Nippon Dojo Hiriyogaku Zasshi* 28, 489-92(1958). CA 53-19263d

954

SEVERAL EXPERIMENTS UTILIZING RADIO-ISOTOPES. Yong-gyu Yi. Chosŏn Kwahakwon T'ongbo, No. 2, 21-2(Apr. 1959).

Test results are given for the phosphorus isotope metabolism balance and irradiation effects on seeds. A phosphorus-base fertilizer proved to be effective for corn, soybeans, and wheat. The proper time for applying phosphorus fertilizer to young plants is when the plants start to develop. The absorption of phosphorus is more active in the young cell of the plant than the old cell. In the soybean plant, the phosphorus observed in the day time returned to the soil during the night. Properly  $\gamma$ -irradiated corn increased its production by 10%. Similar results were obtained with  $\gamma$ -irradiated turnip seeds, and turnip seeds washed in an isotope solution.

955

MALONATE AS A PARTICIPANT IN ORGANIC ACID METABOLISM IN BUSH BEAN LEAVES. R. H. Young and L. M. Shannon (Univ. of California, Los Angeles). *Plant Physiol.* 34, 149-52(1959). CA 53-11545b

956

AEC-tr-3432  
USE OF RADIOACTIVE CARBON  $\text{C}^{14}$  IN THE STUDY OF PHOTOSYNTHESIS. (Metody primeneniya radio-aktivnogo ugleroda  $\text{C}^{14}$  dlya izucheniya fotosinteza). O. V. Zalenskii, O. A. Semikhatova, and V. L. Voznesenskii. Translated from a publication of the Academy of Sciences, S.S.S.R., Moscow (1955). 111p. \$1.50(OTS).

A comprehensive study is reported of applications of carbon-14 in the study of the physiology of photosynthesis. Apparatuses used in the studies are described and illustrated. Carbon-14 was used in investigations of photosynthesis under both laboratory and natural conditions. Investigations were made of both the rate of photosynthesis and the composition of photosynthetic products following the fixation of carbon. 115 references.

957

INVESTIGATION OF FORMATION AND CONVERSION OF CATECHINS IN TEA-LEAVES USING  $\text{C}^{14}\text{O}_2$ . M. N. Zaprometov and A. L. Kursanov. (K. A. Timiryazev Inst. Plant Physiol., Acad. Nauk Sci. U.S.S.R., Moscow). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 2, 310-19 (1958). CA-52: 20443e

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THE SITE OF THE FORMATION OF CATECHINS IN THE TEA PLANT. M. N. Zaprometov. (K. A. Timiryazev Inst. Plant Physiol., Acad. Sci. U.S.S.R., Moscow). *Fiziol. Rastenii, Akad. Nauk S.S.S.R.* 2, 51-61(1958). CA-52: 10298b.

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THE EFFECTS ON THE YIELD OF BARLEY GROWN FROM BARLEY GRAIN TREATED WITH SOLUTIONS OF BORON, MANGANESE, COPPER AND RADIUM. N. G. Zhezheh and N. P. Vard'ya. *Zapiski Leningrad. Sel'skokhoz. Inst.* 1956, 11, 217-20. CA-52: 20426f.

# AUTHOR INDEX

## A

Abdel-Malek, A. A., 216  
 Abe, Michiko, 747-48  
 Abidov, A. Z., 460  
 Abo, Takashi, 285  
 Abrams, Richard, 103  
 Achenbach, H., 426  
 Ackermann, Wilbur, 502  
 Adidov, A. Z., 459  
 Adner, P. L., 288  
 Agababyan, V. Sh., 760  
 Agarwala, S. C., 462  
 Agren, Gunnar, 335  
 Akhromeiko, A. I., 652  
 Aksel'rod, L. B., 302  
 Alekseeva, O. G., 336  
 Alexander, G. V., 866-67  
 Alexander, George J., 572  
 Alexiev, D., 250  
 Alkhazov, D. G., 877  
 Allen, Barbara K., 400  
 Alpen, E. L., 337  
 Alten, F., 338  
 Altmann, Hans, 339  
 Amenomori, Y., 164  
 Amov, B., 250  
 Anderson, D., 156  
 Anderson, I. C., 716  
 Anderson, J. M., 684, 855  
 Anderson, Laurens, 713  
 Andreev, S. V., 217  
 Andreeva, T. F., 653  
 Andrews, J. R., 90  
 Aoyama, T., 340  
 Apelgot, Sonia, 341-42  
 Appleman, M. D., 602  
 Appleyard, R. K., 245  
 Aqvist, S., 408  
 Archer, S. M., 388  
 Arghittu, C., 343-44  
 Arkhipova, O. P., 345-46  
 Arnoff, Harold, 347  
 Arnon, Daniel I., 926  
 Aronoff, S., 655  
 Aronson, A. I., 579  
 Arthur, W., 218  
 Asano, M., 164  
 Askonas, Brigitte A., 289  
 Aso, Sueo, 820-21  
 Astrachan, L., 348, 613  
 Attardi, G., 349  
 Auerbach, S. I., 2, 656  
 Aurisicchio, S., 350  
 Awataguchi, Shigemi, 290

## B

Babicky, A., 607  
 Bagatell, Fillmore K., 351  
 Bair, W. J., 352  
 Baldwin, M. M., 425  
 Baldwin, W. F., 219  
 Bale, William F., 291, 330-32  
 Ball, R. C., 175-77  
 Barber, D. A., 657  
 Barinov, G. V., 658-59  
 Barker, S. A., 353  
 Barkulis, S. S., 578  
 Barnes, M. M., 220  
 Barrada, Y., 840  
 Baserga, R., 84-86  
 Bassham, James A., 3, 660, 684  
 Bates, Harold M., 87  
 Bazhanova, N. V., 877  
 Becarevic, A., 905  
 Bedrosian, Paul Harry, 661  
 Beevers, H., 768  
 Bektemirov, T. A., 354  
 Bell, M. C., 628  
 Belov, A. D., 63  
 Belozerskii, A. N., 363, 479, 621  
 Belykh, G. A., 608  
 Benes, J., 622  
 Bennett, E. L., 662  
 Bennett, L. L., 88  
 Benson, A. A., 4, 663-65  
 Bentley, Orville G., 395  
 Bentley, R. E., 629  
 Berends, W., 605  
 Berezina, N. M., 666  
 Berezovskii, B. S., 89  
 Bergdoll, M. S., 588  
 Bergmann, Fred H., 355  
 Bergstrom, R. M., 668  
 Bernstein, I. A., 356  
 Berquist, P. L., 667  
 Berry, R. J., 90  
 Berson, Solomon A., 292  
 Bertrand, A. R., 839  
 Bessman, Maurice J., 490  
 Betto, E., 669  
 Beutler, Ernest, 137  
 Bevenus, Arthur, 792-93  
 Bfrnier, G., 670  
 Bhattacharjee, S. B., 91  
 Bialy, Jerzy J., 357  
 Biddulph, O., 671, 934  
 Biddulph, Susann, 671  
 Bidwell, R. G. S., 672-73, 909  
 Bidzilya, M. I., 674-75, 943

## AUTHOR INDEX

- Biebl, R., 676  
 Bien, George S., 677  
 Bilinski, E., 809  
 Billek, G., 769  
 Biozzi, G., 92  
 Birt, L. M., 679  
 Biswas, B. B., 680  
 Blafield, R. F., 668  
 Blake, M. I., 681, 914  
 Blaschko, H., 148  
 Blass, U., 684  
 Bloch, Bertrand, 682  
 Boerner, W., 246  
 Bolton, E. T., 509  
 Bond, Victor P., 152, 248  
 Bonner, James, 719, 791, 854  
 Boone, Irene U., 358, 548  
 Borek, Ernest, 359  
 Borisova, M. N., 773  
 Boroughs, Howard, 178  
 Bostic, W. L., 160  
 Bowen, C. C., 269  
 Bowser, Helen R., 360  
 Brandkamp, W. W., 134  
 Braun, O. H., 496  
 Brecher, George, 248  
 Bregadze, Yu. I., 780-81  
 Brenner, M. W., 668  
 Brenner, S., 349  
 Brockman, H. Wallace, 93  
 Brodsky, Isadore, 492  
 Brovchenko, M. I., 777  
 Brown, David H., 420  
 Brown, G. N., 198  
 Brown, I. C., 815  
 Broyer, T. C., 912  
 Bruce, V. G., 94  
 Brueggemann, J., 361  
 Brumfit, W., 362  
 Buchsbaum, Ralph, 24  
 Buchtela, K., 769  
 Buescher, R. G., 628  
 Bukhovich, E., 363  
 Bukrinskaya, A. G., 364  
 Burchall, J. J., 474  
 Burducea, O., 293-94, 366  
 Burrell, R. C., 916  
 Burris, R. H., 355, 713  
 Bustad, L. K., 634  
 Butler, J. A. V., 365  
 Buzini, P. A., 314-15  
 Byerrum, Richard U., 730  
 Cavalli-Sforza, L. L., 247  
 Cepleanu, M., 293-94, 366  
 Cermak, Vladimir, 371  
 Cerna, Jirina, 371  
 Ceruti, Arturo, 685  
 Cetini, Giuseppe, 685  
 Chailakhyan, M. Kh., 777  
 Chakhava, O. V., 297  
 Chaloupka, J., 372-73  
 Chantrenne, H., 374  
 Cheldelin, Vernon H., 465  
 Chen, Chin-Ching, 686  
 Chen, S. L., 375-76  
 Cheng, P. Y., 96  
 Chiba, S., 298  
 Chorney, William, 49, 687  
 Christian, John E., 788  
 Chudnow, I., 368  
 Church, Brooks D., 434  
 Ciobanu, I., 865  
 Cleverdon, R. C., 519  
 Clifton, C. E., 452  
 Cline, J. F., 688-93, 744-45  
 Cohen, Seymour S., 494  
 Cohn, Mildred, 377  
 Cole, L. B., 144, 548  
 Collins, J. F., 470  
 Colvin, J. R., 728  
 Comar, C. L., 643-45  
 Conches, Lucia, 584-86  
 Connell, George E., 379-80  
 Conrad, S. M., 387, 709  
 Conway, E. J., 381  
 Cooper, P. D., 97  
 Copelovici, Y., 366  
 Cornatzer, W. E., 133  
 Cortini, G., 350  
 Cory, R., 671  
 Cotty, Val. F., 221  
 Coulaud, E., 382  
 Countryman, Joan L., 383, 613  
 Courtois, G., 222  
 Cowie, Lillian, 919  
 Craddock, Valda M., 87  
 Craigie, J. S., 673, 919  
 Crathorn, A. R., 365, 384  
 Crawford, L. V., 385-86  
 Creaser, E. H., 98, 396  
 Crespi, H. L., 49, 387-88, 687, 913-15  
 Cronkite, Eugene P., 152, 248  
 Crosbie, G. W., 389  
 Crossley, D. A., Jr., 2, 198, 223-25, 249, 656  
 Crow, James F., 249  
 Csukas, I., 251  
 Curci, G., 299  
 Curry, La Verne L., 226  
 Curtin, J. A., 441

### C

- Cajal, N., 366  
 Caldecott, Richard S., 245, 264, 271  
 Caldwell, P. C., 95  
 Calvin, Melvin, 660, 662, 683-84, 816-17, 825-28, 855  
 Capindale, John B., 870  
 Caprarur, R., 293  
 Carenza, P., 295  
 Caro, Lucien G., 367  
 Carp, Richard I., 368-69, 506  
 Carr, Charles W., 296  
 Case, A. C., 188  
 Casey, H. W., 634  
 Caspar, A., 901  
 Castagnoli, C., 370

### D

- D'Addabbo, A., 300  
 Daniel, F. A., 251  
 Das Gupta, N. N., 91  
 David, H. T., 269  
 Davidson, J. N., 100  
 Davidson, R. S., 425  
 Davis, George K., 630  
 Davis, J. J., 210-12  
 Dawes, E. A., 390, 446

## AUTHOR INDEX

Day, Paul L., 400  
 Deering, R. A., 391  
 De Favelukes, Susana L. S., 584-86  
 Defendi, Vittorio, 130, 506  
 De Giovanni, Rosali, 392-94  
 Dehority, Burk A., 395  
 De Leon, R. P., 98, 396  
 Delwiche, C. C., 759  
 DeMoss, J. A., 397  
 Demott, B. J., 398  
 Dendy, P. P., 138  
 Denisenko, L. K., 240  
 De Terra, N., 99  
 Devoret, R., 399  
 Devreux, S., 374  
 Dibeler, V. H., 422  
 Di Chiro, G., 332  
 Dickson, M., 100  
 Di Miceli, A., 136  
 Dinning, James S., 400, 442  
 Dixon, D., 834  
 Dixon, Frank J., 301  
 Dobberstein, Horst, 568  
 Doi, Roy, 434  
 Doman, N. G., 401, 694-95, 936  
 Domaradskii, I. V., 402-3  
 Donohue, J., 602  
 Doudoroff, M., 404  
 Dow, R. P., 227  
 Dowrick, G. J., 952  
 Drasil, V., 529  
 Drew, Ruth M., 101-2, 141-42  
 Dreyfus, G., 104  
 Drozhzhina, V. V., 666  
 Dubovyi, E. D., 302  
 Ducet, G., 696  
 Dudley, Carlton, 888  
 Duggan, P. F., 381  
 Dunaway, P. B., 2  
 Dunham, C. L., 26  
 Dunning, G. M., 631  
 Duranton, Henri, 697-98, 824  
 Duranton, Jacques, 699  
 Dworak, W., 525

### E

Ealy, R. P., 700  
 Eberhardt, Frank M., 701  
 Ebert, M., 705  
 Edelman, J., 852, 890  
 Edison, N. L., 405  
 Edmonds, Mary, 103  
 Edwards, R. R., 27  
 Eftimov, B., 250  
 Eggleston, L. V., 406  
 Ego, Winifred, 178  
 Eidelman, Z. M., 877  
 Eisenstadt, Jerome M., 407, 566  
 El Gindi, D. M., 840  
 Eliasson, N. A., 408  
 Emma, V., 350  
 Emmert, Fred H., 702-3  
 Enebo, Lennart, 433  
 Engstrom, Lorentz, 409-10  
 Epstein, Samuel, 842-43  
 Erdman, H. E., 228  
 Erdos, T., 411  
 Eriksson, Bengt, 182  
 Essel, A. E., 325  
 Essington, E., 704

Eto, Masako, 747-48  
 Evans, E. A., Jr., 536  
 Evans, N. T. S., 705  
 Everhardy, W. H., 742  
 Extermann, R. C., 706

### F

Faigle, H., 771  
 Faine, S., 412  
 Faludi, B., 251  
 Fan, K., 413  
 Fang, S. C., 707  
 Feist, Donald J., 133  
 Fellinger, K., 28-29  
 Fernando, A. N., 303  
 Ferrari, R. A., 664  
 Fiedler, F., 925  
 Fink, Kay, 252-53  
 Fink, R. M., 252-53  
 Finkel, A. J., 49  
 Finlayson, J. S., 104  
 Firket, H., 168  
 Fischer, J., 308  
 Fischer, Robert G., 133  
 Fitch, Frank W., 304  
 Fitz-James, P. C., 579  
 Fitzgerald, B. W., 179  
 Flaumenhaft, E., 709  
 Fleckenstein, A., 105-6  
 Flory, W. S., Jr., 901  
 Foa, R., 669  
 Foconi, S., 288  
 Folster, H., 884  
 Ford, Harrell T., 444  
 Foreman, E. E., 710  
 Forro, Frederick, Jr., 367, 544  
 Forssberg, A., 104  
 Foster, R. F., 180-81  
 Fourie, S., 801  
 Fowden, L., 711  
 Fowler, J. F., 530  
 Fox, Maurice S., 414  
 Francis, F. J., 712  
 Francis, G. E., 30, 305  
 Frank, P., 616  
 Frazier, John C., 887  
 Frear, D. Stuart, 916  
 Fredriksson, Lars, 182, 859  
 Fremstad, J. K., 637  
 French, N. R., 183  
 French, S. W., 415  
 Freundt, K. J., 106  
 Friedell, Hymer L., 327  
 Friedman, Irving, 422, 476  
 Friedrich-Frekssa, H., 254, 463-64  
 Fritz, G. J., 713  
 Frolen, H., 261  
 Fromageot, P., 714  
 Frye, W. W., 554  
 Fuerst, C. R., 416, 582  
 Fujiwara, Akio, 715  
 Fukai, R., 184  
 Fuller, R. C., 716-17

### G

Gabrielyan, G. G., 760  
 Gaby, W. L., 417  
 Gaglione, P., 718  
 Gahne, Bo, 859  
 Gaisch, H., 418

# AUTHOR INDEX

Gal, D., 419  
 Galkina, V. S., 459  
 Galmiche, Jean Michel, 699  
 Gamo, Toshioki, 229  
 Garcia, Manuel Nieto, 185  
 Garner, R. J., 186, 875  
 Gates, C. T., 719  
 Geller, I. A., 720  
 Georgi, Carl E., 546  
 Gerlach, E., 105-7  
 Gerloff, R. K., 306  
 Gess, James A., 887  
 Getsova, A. B., 230-31  
 Geyer, Robert P., 108-9  
 Gibbs, H. C., 632  
 Gibbs, Martin, 721, 757  
 Giesecke, D., 361  
 Gileva, E. A., 209  
 Giraud, Georges, 722  
 Girolami, A., 295  
 Girshin, A. B., 877  
 Giudice, G., 110, 136  
 Glaser, Luis, 420  
 Glasky, Alvin J., 421  
 Gloud, P. E., Jr., 422  
 Glueckauf, E., 205  
 Godnev, T. N., 723, 893-94  
 Godt, K. J., 724  
 Goerke, W., 895  
 Golban, N. D., 302  
 Goldstein, Lester, 111  
 Goldwasser, Eugene, 121  
 Gomez-Sanchez, A., 353  
 Gonzalez, Juan de Dios Lopez, 725  
 Goodland, Ruth L., 291, 330-32  
 Goodman, Harold S., 307  
 Goodwin, T. W., 726  
 Gopal-Ahengar, A. R., 727  
 Gorham, Paul R., 728, 833, 846  
 Goss, James A., 729  
 Grabe, Barbro, 31  
 Graham, A. F., 112, 172, 597  
 Gramlich, F., 308  
 Gray, L. H., 255  
 Graziosi, F., 350, 370  
 Grec, S., 525  
 Grechko, V. V., 423-24, 573  
 Greenhouse, Samuel W., 248  
 Greenlee, R. W., 425  
 Griffith, Thomas, 730  
 Grinevich, A. G., 483  
 Grisebach, H., 426  
 Gromet, Z., 570  
 Gros, F., 349, 427  
 Gros-Douclet, Francoise, 427  
 Grosch, Daniel S., 187, 232-34  
 Gross, E., 105  
 Gross, Julian D., 256  
 Gross, Marcie C., 166  
 Gross, P. R., 32  
 Grossbard, E., 428  
 Guelin, Antonina, 429-32  
 Gulyakin, I. V., 731-32  
 Guminskaya, M. A., 930  
 Gunar, I. I., 733  
 Gunnar, Agren, 335  
 Gurvich, A. E., 309-10  
 Guthenberg, Hans, 433  
 Gwatkin, R. B. L., 172

# H

Habermann, Helen M., 734  
 Hacskeylo, Edward, 812  
 Hagen, Cal E., 735  
 Hahn, P. F., 33  
 Haken, J. W., 633  
 Halpern, B. N., 92  
 Halvorson, Harlyn O., 434-35  
 Hamada, Kazuyoshi, 823  
 Hammarsten, E., 408, 436  
 Hancock, R., 437  
 Handley, Raymond, 818  
 Hansbury, E., 762-63  
 Hanson, Wayne C., 188, 199, 211-12  
 Hardon, H. J., 633  
 Harford, C. G., 478  
 Harley, C. P., 736  
 Harper, Paul V., 304  
 Harriman, P. D., 272  
 Harrington, Helen, 113  
 Harris, E. J., 114  
 Harris, H., 171  
 Harris, Henry C., 737  
 Hartley, Janet W., 127  
 Hartman, P. E., 438  
 Hartzell, Richard W., Jr., 130, 155, 477, 506, 561  
 Hase, Eiji, 439  
 Hashimoto, Yasuji, 738  
 Hasterlik, R. J., 49  
 Haurowitz, Felix, 128, 311  
 Hawkins, J. D., 305  
 Hayashi, J. A., 578  
 Hayes, Ellen H., 88  
 Hayes, F. N., 762-63  
 Healy, J. W., 36-42  
 Heath, Edward C., 440  
 Heckstall-Smith, H. W., 43  
 Heim, A. H., 441  
 Hein, R. E., 886  
 Heinz, Erich, 115  
 Hellman, A., 116-17  
 Henderson, T. R., 442  
 Hendricks, Sterling B., 735  
 Henry, S. Mark, 221  
 Herbst, W., 739  
 Hercik, F., 443  
 Hestrin, Shlomo, 570  
 Heyssel, Robert M., 44  
 Hilchey, John D., 221  
 Hill, C. R., 740  
 Hill, M., 118  
 Hiramoto, Raymond, 322  
 Hirayama, Toru, 823  
 Hirokawa, Toyoyasu, 741  
 Hirokawa, Y., 164  
 Hobson, E. L., 856  
 Hoelzel, F., 119  
 Hoering, Thomas C., 444  
 Hofbauer, G., 770  
 Hofer, R., 29  
 Hoffman, Dale A., 189  
 Hoffmann, Josef, 742  
 Hoffmeister, F., 451  
 Hofheinz, W., 426  
 Holden, Joseph T., 445  
 Holm-Hansen, O., 662, 684, 828  
 Holman, Jane, 445

## AUTHOR INDEX

Holms, W. H., 390, 446  
 Holmstedt, B., 273  
 Holt, H. C., 398  
 Hooper, F. F., 175-77  
 Hopkins, Theodore L., 235  
 Horiuchi, S., 447  
 Horiuchi, Tadao, 447-48  
 Hosoda, Junko, 533  
 Howard, F. D., 743  
 Howden, Henry F., 224  
 Hoyer, B. H., 306  
 Hueskens, G., 569  
 Hughes, A. M., 415, 662  
 Hughes, D. E., 449  
 Hughes, Walter L., 141, 544  
 Humphrey, J. H., 289, 312  
 Hunebelle, G., 168  
 Hungate, F. P., 352, 688, 744-45, 934  
 Hunt, A. L., 449  
 Hunter, G. D., 365, 384  
 Hunter, G. J. E., 405  
 Hurd, F. J. R., 679  
 Hutchinson, A., 746  
 Hutchinson, E., 45

### I

Ichikawa, Ryushi, 747-48  
 Il'in, D. I., 190  
 Ilkov, T., 507  
 Imaseki, Izumi, 749  
 Isaev, B. M., 780-81  
 Ishizuka, Kozo, 820-21  
 Isoda, Ryuzo, 738  
 Ivanko, Shtefan, 751  
 Ivanova, G. F., 889  
 Ives, K. J., 752  
 Iwashima, K., 214-15, 648  
 Izzo, M. J., 331

### J

Jackson, A. L., 324  
 Jacob, F., 349, 487  
 Jacobson, Leon O., 47, 121  
 Janecek, J., 373  
 Jang, Rosie, 792-94  
 Jeener, R., 450  
 Jeffrey, R. N., 929  
 Jenkins, D. W., 191  
 Jenny, Hans, 725  
 Jerchel, D., 451, 569  
 Jitts, H. R., 753  
 Johnson, B. Connor, 170  
 Johnson, Emmett J., 452  
 Johnson, Robert Frederick, 192  
 Johnson, Ronald R., 395  
 Joklik, W. K., 453  
 Jolchine, G., 754, 829  
 Joner, P. E., 458  
 Jordan, D. C., 454  
 Judis, J., 455  
 Jyssum, K., 456-58

### K

Kabisch, William T., 122  
 Kaganove, A. S., 681  
 Kahn, R. E., 313  
 Kaindl, Karl, 339  
 Kalinina, E. F., 459-61

Kamen, Martin D., 48  
 Kandler, Otto, 721, 755-58  
 Kaplan, W. D., 258  
 Kapoor, N. K., 462  
 Kara, J., 576  
 Kasai, Zenzaburo, 876  
 Kasting, R., 759  
 Kates, Morris, 701  
 Kating, Horst, 899  
 Katsunuma, Rokuro, 285  
 Katz, Joseph J., 49-50, 387-88, 681, 687, 709, 913-15  
 Katznelson, H., 237  
 Kaudewitz, F., 254, 463-64  
 Kawai, Takeshi, 263  
 Kavin, B., 259  
 Kazaryan, V. O., 760  
 Kazmierczak, J. E., 580  
 Keech, D. B., 552  
 Keeling, Charles D., 761  
 Kemp, H. T., 425  
 Kennedy, Jane, 550  
 Kerr, V. N., 762-63  
 Ketchum, Bostwick H., 193  
 Kevan, D. K. McE., 216  
 Keynes, R. D., 95  
 Khalil, M. S., 764  
 Khristov, V., 851  
 Khudadov, G. D., 238  
 Khvostova, V. V., 780-81  
 Kigoshi, Kunihiro, 765-66  
 Kim, H. S., 767  
 King, Tsao, E., 465  
 Kirk, M., 660  
 Kirschfeld, Sigrid, 614  
 Kiselev, P. N., 314-15  
 Kisielewski, W. E., 84-86  
 Kitos, Paul A., 465  
 Klamerth, Olaf, 466  
 Klein, E., 769  
 Klein, Harold P., 407, 566  
 Klitgaard, H. M., 319  
 Kloke, A., 884  
 Klungsoyr, Leiv, 467  
 Koch, Gebhard, 468  
 Konshin, A. A., 302  
 Konstantinov, G., 250  
 Koontz, H., 671  
 Koprowski, Hilary, 368-69  
 Kornberg, Arthur, 490  
 Kornberg, H. A., 51, 194  
 Kornberg, H. L., 469-72, 768  
 Koshland, D. E., Jr., 473  
 Kositsyn, A. V., 892  
 Kowa, Yoshio, 482  
 Kozinn, P. J., 474  
 Kozinski, A. W., 438, 475  
 Krane, S. A., 269  
 Krastina, E. E., 733  
 Kratzl, I. K., 769-71  
 Kretovich, V. L., 772  
 Krichevsky, Micah I., 476  
 Kritchinsky, David, 52-53, 130, 154-55, 368-69, 477, 506, 561  
 Kroger, E., 496  
 Krotkov, G., 673, 919  
 Krygier, A., 525  
 Krylov, A. V., 773  
 Kudnicki, T., 774  
 Kudriavtzev, Alexandre A., 236  
 Kues, Gunter, 899  
 Kuhn, N. O., 478



## AUTHOR INDEX

Kuhns, W. J., 316  
 Kukel, Iu. P., 939  
 Kulaev, I. S., 479  
 Kulaeva, O. N., 775, 778  
 Kulka, R. G., 405  
 Kunitake, George M., 776  
 Kurihara, Kiyoshi, 822-23  
 Kuriki, Yoshitaka, 538  
 Kurosu, Moriji, 123  
 Kursanov, A. L., 775, 777-79, 957  
 Kurylowicz, W., 480-81, 545  
 Kusunose, Emi, 482  
 Kusunose, Masamichi, 482  
 Kuzin, A. M., 54, 780-82, 923  
 Kuznetsov, S. I., 783  
 Kvasnikov, E. N., 483-84

### L

LaChance, Leo E., 232  
 Lacorte, J. G., 485  
 LaCour, L. F., 257  
 Lambina, V. A., 486  
 Larson, K. H., 834, 866-69  
 Laszlo, D., 55  
 Latarjet, R., 342  
 Laurencot, Henry J., Jr., 950  
 Lavalie, R., 487  
 Laver, W. G., 124  
 Lavik, Paul S., 113  
 Lavillaureix, Jean, 125-26  
 Lavollay, Jean, 803  
 Leach, Franklin R., 488  
 Lebedeva, G. D., 195  
 Lecomte, J., 222  
 Ledbetter, Myron C., 784, 906  
 Ledoux, L., 145  
 Lee, C. C., 785  
 Lee, M. L., 489  
 Lefrancois, Marcel, 786  
 Lehman, I. R., 490  
 Lemberg, I. Kh., 877  
 Lengyel, Peter, 379  
 Lepine, Pierre, 429-32  
 LeRoy, G. M., 867  
 Lerman, L. S., 260  
 Leskowitz, S., 313  
 Lesley, J. W., 787  
 Lesley, Margaret M., 787  
 Lester, William, Jr., 49, 491  
 Levin, G. V., 441  
 Levy, Hilton B., 127, 492  
 Lewis, H. L., 547  
 Ley, F. J., 493  
 Lieberman, Herbert, 788  
 Liebster, J., 372-73, 607  
 Lietze, Arthur, 128  
 Linck, A. J., 917  
 Lindeman, W., 789  
 Lindquist, A. W., 239  
 Linko, Pekka, 790  
 Lockhart, James A., 791  
 Loeb, Marilyn R., 494  
 Loewus, Frank A., 792-95, 904  
 Logan, Anne C., 143  
 Logan, C., 417  
 Logan, R., 129  
 Logie, L. C., 156  
 Loh, Philip C., 502  
 Loitsyanskaya, M. S., 495  
 Loken, M. K., 158

Lonberg-Holm, K. K., 662  
 Looney, Della, 580  
 Loughman, B. C., 796-97  
 Loures, J. C., 485  
 Lowell, F. C., 313  
 Lowenstein, J. M., 449  
 Lubben, K., 105  
 Lucas, H. F., Jr., 196  
 Lucas, J. W., 849  
 Lucel, J., 510  
 Luderitz, Otto, 496  
 Ludwig, F., 882-83  
 Lugoši, L., 497  
 Lund, R. O., 160  
 Luning, K. G., 261  
 Lustinec, J., 798  
 L'vitsina, G. M., 336  
 Lwoff, Andre, 498-501  
 Lwoff, Marguerite, 498-501  
 Lyakhnovich, Ya. P., 723, 893-94

### M

Maassab, H. F., 502  
 Mackal, Roy P., 536  
 MacLachlan, G. A., 799  
 MacQueen, K. F., 632  
 MacVicar, Robert, 800  
 Madsen, N. B., 469  
 Magasanik, Boris, 360  
 Magasanik, Revel, 360  
 Magee, W. E., 503  
 Majer, J., 607  
 Malec, J., 504  
 Malvicini, A., 718  
 Mandel, H. G., 337  
 Mandelstam, J., 505  
 Mann, Walter, Jr., 792-94  
 Manson, Lionel A., 130, 155, 477, 506, 561  
 Marais, P. G., 801  
 Marckwordt, U., 949  
 Marco, G., 865  
 Marco, T., 865  
 Marcovich, H., 524  
 Marinescu, G., 366  
 Markov, K. I., 507  
 Marsden, Ernest, 802  
 Marsland, D., 262  
 Martak, D. S., 154  
 Martens, B. K., 217  
 Martens, L. A., 240  
 Martin, E. M., 504  
 Martin, Georges, 803  
 Martin, P. G., 646  
 Martin, R. P., 797  
 Masima, Isao, 263  
 Matsumura, S., 805  
 Mauro, B., 510-11, 665  
 Mavrodineanu, Radu, 784  
 Maslova, T. G., 877  
 Masouredis, S. P., 316-18  
 Massini, P., 804  
 Mastiukova, Iu. N., 354  
 Mateescu, S., 366  
 Matheson, A. T., 508  
 Mathews, R. E., 509  
 Matsumura, S., 805  
 Mauro, B., 510-11, 665  
 Mavrodineanu, Radu, 784

## AUTHOR INDEX

Mazelis, Mendel, 806  
 McAfee, Robert D., 512  
 McClellan, R. O., 634  
 McCollum, John P., 807  
 McConnell, W. B., 808-10  
 McConnon, Dan, 181  
 McFall, Elizabeth, 513-14  
 McKissic, E. M., Jr., 588  
 McLaren, L. C., 158, 306  
 McNutt, Walter S., Jr., 515-16, 576  
 Mead, James F., 131  
 Meade, R. C., 319  
 Mechsner, Kl., 617  
 Medvedev, Zh. A., 811  
 Mehta, Ranjan, 170  
 Meissner, Johannes, 56-58  
 Melin, Elisa, 812  
 Melnykovych, G., 132  
 Meneely, George R., 44  
 Menzel, Ronald, G., 813-15  
 Merchant, D. J., 116-17  
 Metzner, Barbara, 816-17  
 Metzner, Helmut, 816-17  
 Michi, K., 164  
 Micou, Julie, 111  
 Middleton, Lawrence J., 818  
 Midorikawa, Shigeo, 229  
 Miettinen, Jorma K., 517, 819  
 Mihara, Sayoko, 439  
 Milbourn, G. M., 874  
 Miles, H. Todd, 518  
 Miller, J. A., 664  
 Miller, P. A., 132  
 Miller, Wilmer G., 713  
 Mirhoff, George, 133  
 Mirita, Sigehiro, 593  
 Miskulin, A., 616  
 Misyuk, L. A., 863  
 Mitsui, Shingo, 820-23  
 Miyachi, Shigetoh, 741  
 Mizuno, Denichi, 447-48  
 Mogilevkin, V. B., 927  
 Mohler, Bobby A., 465  
 Mohring, D., 308  
 Molchanova, V. A., 217  
 Moll, E., 246  
 Monteiro, E., 485  
 Moon, H. H., 736  
 Moore, J. G., 134  
 Morel, Georges, 824  
 Morishita, Teizo, 823  
 Morowitz, Harold J., 519-20  
 Mortlock, R. P., 521-22  
 Moschette, D. S., 646  
 Moser, Herbert C., 887  
 Moses, Vivian, 662, 684, 825-28  
 Moskalev, Yu. I., 190  
 Mosser, D. G., 158  
 Moustacchi, E., 523-24  
 Mouton, D., 92  
 Moxon, A. L., 395  
 Moyse, A., 754, 829  
 Mulligan, W., 30  
 Munro, T. R., 135  
 Murczynaska, W., 525  
 Mutolo, V., 110, 136  
 Myers, W. M., 264  
 Myhre, Donald L., 813

### N

Nagorbina, E. S., 526

Nakanishi, Y. H., 156  
 Nance, James F., 830  
 Naono, S., 349  
 Natarajan, A. T., 831  
 Nathan, H. A., 716  
 Naughten, R. N., 417  
 Naumann, Delbert A., 886  
 Neary, G. J., 657  
 Necheles, Thomas, 137  
 Neel, J. W., 868  
 Neidle, Amos, 527  
 Neimark, Joyce M., 108-9  
 Neish, A. C., 832  
 Nelson, A., 261  
 Nelson, Barbara G., 133  
 Nelson, C. D., 833, 846  
 Nelson, D. J., 197  
 Nemirovich-Danchenko, O. R., 528  
 Nermut, M. V., 529  
 Nesmeianova, S. I., 459  
 Neter, Erwin, 496  
 Neuberger, A., 124  
 Newbould, P., 873  
 Newell, Marcia F., 476  
 Newton, Alison, 138  
 Nicholas, D. J., 530  
 Nicola, Orsini, F. F., 59  
 Niedetsky, A., 139  
 Nieset, Robert T., 512  
 Nilsson, Harald, 812  
 Ninkov, V., 149  
 Ninni, A., 299  
 Nishida, Shoji, 531  
 Nishita, H., 704, 834, 866, 868-69  
 Nishiyama, Hisao, 229  
 Noble, E. P., 532  
 Nomura, Masayasu, 533-34  
 Norris, F. W., 921  
 Novelli, G. David, 557  
 Novokreshchenova, N. S., 240  
 Novozhilova, L. P., 621  
 Noyes, Howard E., 563  
 Numerof, P., 474  
 Nunez, Constantino, 835  
 Nye, Joseph F., 618

### O

Obolensky, Georges, 836  
 O'Brien, R. T., 535  
 O'Donnell, James F., 536  
 Oehlert, Wolfgang, 537  
 Oftedal, Per, 241-42, 265  
 Okazaki, Reiji, 538  
 Okazaki, Tsuneko, 538  
 Okuda, Azuma, 876  
 Okuneva, L. A., 939  
 Olafson, J. H., 868-69  
 O'Leary, William M., 539  
 Olive, John R., 189  
 Olson, J. S., 198  
 Omura, H., 619  
 Opritov, V. A., 837  
 Ord, M. G., 148  
 Ordin, L., 838  
 Ormerod, J. G., 540  
 Oros, J., 202  
 Ostrowski, W., 541-43  
 Oswalt, D. L., 839  
 Otief, B. A., 840  
 Otsuka, Hama, 439

## AUTHOR INDEX

Ouellet, Cyrias, 786  
Ovcharov, K. E., 773  
Overstreet, Roy, 818

### P

Paganelli, C. V., 140  
Pagano, P. G., 267, 600  
Painter, Robert B., 101-2, 141-42, 544  
Palmstierna, H., 408, 436  
Pan, I. H., 489  
Panteleeva, E. I., 841  
Pantiukhina, E. A., 483  
Paque, C., 635  
Pardee, A. B., 514, 553, 556  
Park, Roderic, 842-43  
Parker, H. M., 61  
Parovina, M., 844  
Pasquier, J. F., 480-81, 510-11, 545  
Passaggio, A. M., 267  
Passalacqua, Ferdinando, 62  
Patterson, R., 320  
Paul, J., 100  
Pauling, Linus, 266  
Pavlinova, O. A., 777  
Pazur, John H., 546  
Pelc, S. R., 257  
Pellegrini, A., 267, 600  
Pelling, G., 268  
Pendleton, Robert C., 199-200, 845  
Perez-Milan, H., 714  
Perkins, Harold J., 833, 846  
Pershad, Guru D., 269  
Person, S., 547  
Peters, Theodore, Jr., 143  
Petersen, D. F., 144, 548  
Petrov-Spiridonov, A. E., 733  
Petrova, A. I., 190  
Petrova, O. N., 863  
Petru, E., 798  
Petrushenko, O. P., 484  
Petty, Robert, 201  
Pfeiffer, Hans H., 847  
Piccotti, F., 321  
Pickering, D. C., 849  
Pickering, Quentin, 213  
Pigretti, M. Martha, 584  
Pileri, A., 145  
Pittendrigh, C. S., 94  
Plakhotin, M. V., 63  
Platonova, L. V., 863  
Plough, Harold H., 270  
Plumb, Mary Ellen, 187  
Plyshevskaya, E. G., 928, 930  
Pokorna, V., 798  
Pokrovskaya, N. V., 609  
Polikarpov, G. G., 207, 850  
Pollard, Ernest, 549-50  
Pomerat, C. M., 156  
Pon, N. G., 684, 855  
Ponder, Eric, 146  
Ponder, Ruth V., 146  
Ponticorvo, Laura, 359  
Pop, E., 865  
Popov, Ivan D., 851  
Popova, E. I., 207  
Popova, I. A., 877  
Popova, O. F., 877  
Pora, A. Eugene, 202, 236  
Porter, H. K., 799, 852  
Postlethwait, S. N., 853

Povelyagina, Z. S., 203  
Powell, R. D., 551  
Powell, R. G., 861  
Prandini, B. D., 344  
Pranker, T. A. J., 114  
Pratt, David, 271-72  
Pressman, David, 322, 333  
Prokopenko, T. A., 147  
Proskey, L., 636  
Prusoff, W. H., 148  
Pruzansky, J. J., 320  
Pryor, M. E., 225  
Pullin, J. W., 632  
Purcell, A. E., 854

### Q

Quastler, H., 907  
Quayle, J. R., 472, 552  
Quellet, Cyrias, 786  
Quilligan, J. J., Jr., 323

### R

Rabin, B. R., 855  
Rachmeler, M., 553  
Racusen, David, 856  
Radotic, M., 149  
Rafelson, Max E., Jr., 347, 421  
Ragni, G., 150  
Rajam, P. C., 324  
Rakhtenko, I. N., 858  
Ramenskaya, G. P., 364  
Ramos, Eugenia, 584  
Ramstad, Egil, 788  
Rankin, J. S., 179  
Ranson, S. L., 946  
Rasmuson, Bertil, 273, 859  
Rassudov, S. M., 325  
Rathblat, G. H., 154  
Ratner, E. I., 659  
Reed, D. R., 532  
Reeves, R. E., 554  
Regeimbal, L. O., 736  
Reid, W. W., 860  
Reinhold, Leonora, 861  
Remer, Ellen, 555  
Reznik, Hans, 862  
Rhodes, J. M., 326  
Rick, G. R., 863  
Rickard, W. H., 637  
Riehl, Louis A., 948  
Rigas, Demetrios A., 151  
Riley, Monica, 556  
Rinne, Robert William, 864  
Ripan, R., 865  
Rittenberg, D., 359  
Rivera, L. T., 548  
Riza-Zade, R. R., 666  
Robb, J. A., 237  
Robbins, William E., 235  
Roberts, Howard, Jr., 813  
Robertson, J. S., 152  
Rogers, Betty S., 358  
Rogers, Bruce, 853  
Rogers, H. J., 505  
Rogers, Palmer, 557  
Romanova, A. K., 401  
Romney, E. M., 729, 866-69  
Ronnback, C., 261  
Rorsch, A., 558

## AUTHOR INDEX

Roseman, Saul, 440  
 Rosenberg, Albert J., 153  
 Rosenberg, J., 696  
 Rosenberg, Lawson L., 870  
 Rosenbergova, M., 559  
 Rotfiarb, R. M., 893-94  
 Rothblat, G. H., 154  
 Rothstein, Aser, 560  
 Rothstein, E. L., 155, 506, 561  
 Rotschi, H., 753  
 Rounds, D. E., 156  
 Roux, Eugene, 699  
 Rowe, C. E., 157  
 Rowe, Wallace P., 127  
 Roy, Chitra, 746  
 Rubin, B. A., 936  
 Rudkin, George T., 274  
 Rudnicki, T., 275  
 Rummel, A., 246  
 Runeckles, V. C., 871  
 Rusdea, D., 202  
 Russell, R. Scott, 205-6, 796, 872-75  
 Rylkin, S. S., 562, 609  
 Ryzhkov, Yu. D., 325

### S

Saakov, V. S., 877  
 Sable, Henry Z., 351  
 Sacredote, F. L., 585-86  
 Saenko, G. N., 782  
 Saev, G. K., 507  
 Sagar, P., 462  
 Sagik, B. P., 503  
 Sakaguchi, Takashi, 876  
 Salerno, Paul R., 327  
 Salmon, R. J., 158  
 Saltman, Paul, 776  
 Samuel, I., 294  
 Sancho, Francisco M. Sarasola, 940  
 Sandegren, Evald, 433  
 Sanders, P. C., 144, 548  
 Sanford, Catharine, A., 143  
 Sanford, J. P., 563  
 Sanghvi, L. D., 276  
 Sannazzari, G. L., 321  
 Sapozhnikov, D. I., 877  
 Sarkar, M., 91  
 Sasaoka, Kei, 878  
 Satarova, N. A., 879  
 Sato, A., 564  
 Sattler, E. L., 880  
 Sauerbeck, D., 881  
 Sawayanagi, Shoichi, 823  
 Schaeffer, Pierre, 565  
 Scheffer, F., 882-85  
 Schiff, Jerome A., 566  
 Schlegel, David E., 567  
 Schmidt, Bernh., 568  
 Schmidt, H. L., 569  
 Schnell, Jay H., 223  
 Schofield, R., 159, 873  
 Scholefield, P. G., 98  
 Schramm, M., 570  
 Schreier, K., 642  
 Schrenk, W. G., 886  
 Schuetzsack, U., 638  
 Schumaker, V. N., 571  
 Schweinfurth, D. I., 554  
 Schwenk, Erwin, 572  
 Schwien, William G., 887  
 Scully, N., 49  
 Scully, Norbert J., 687  
 Seber, Almera, 491  
 Sedova, T. S., 423-24, 573  
 Seegmiller, C. G., 794  
 Semenushkina, A. F., 402-3  
 Semikhatova, O. A., 956  
 Sen, S. P., 680  
 Setter, L. R., 639  
 Shaffer, R. L., 49  
 Shannon, Leland M., 888, 955  
 Shaw, D. F., 855  
 Shcheglova, G. M., 928  
 Shchibria, G. I., 666  
 Shestakov, A. G., 889  
 Shestakova, V. A., 652  
 Shewchuck, S., 877  
 Shibko, S., 890  
 Shil, V. N., 609  
 Shilov, E. A., 891  
 Shiryaeva, G. A., 877  
 Shkol'nik, M. Ya., 892  
 Shlyk, A. A., 723, 893-94  
 Shmel'kova, N. I., 889  
 Shnol', S. E., 286  
 Shuey, Eldon W., 546  
 Siegel, B. V., 160, 415  
 Siegel, O., 895  
 Siekevitz, Philip, 161  
 Sievers, K., 496  
 Silina, E. I., 775  
 Silvester, D. J., 530  
 Simic, Miroslav, 228  
 Siminovitch, L., 112, 172  
 Simmons, Norman S., 473  
 Simms, Ernest S., 490  
 Simon, Helmut, 574, 816, 896-97  
 Simon-Reuss, I., 162  
 Simonis, Wilhelm, 898-900  
 Simpson, Marguerite S., 93  
 Simpson, Melvin V., 87  
 Singer, Leon, 296  
 Singleton, W. R., 901  
 Sisken, Jesse E., 258, 902  
 Sisler, Frederick D., 422, 476  
 Sittkus, Albert, 903  
 Sjolin, S., 288  
 Skarzynski, B., 542  
 Skauen, D. M., 179  
 Skellenger, M. L., 646  
 Skipper, Howard E., 88  
 Skoda, Jan, 329, 575-76  
 Skok, John, 807  
 Smalii, V. T., 577  
 Smirnova, N. P., 309-10  
 Smith, C. L., 138  
 Smithers, Donald, 88  
 Smyrniotis, P. Z., 518  
 Snell, Esmond E., 488  
 Snellbaker, LeRoy F., 127  
 Snyder, Leon A., 245, 264, 271  
 Sobek, J. M., 452  
 Sogo, P. B., 684  
 Sokurova, E. N., 277  
 Soldatkin, I. S., 240  
 Solomon, A. K., 140  
 Sommermeyer, K., 724  
 Sonoda, Susumu, 823  
 Sorkin, E., 226  
 Sorm, Frantisek, 329, 371, 575-76  
 Sormova, Z., 576  
 Southard, W. H., 578

## AUTHOR INDEX

Spar, Irving L., 291, 330-32  
 Sparks, M., Carolyn, 93  
 Sparrow, A. H., 908  
 Spiegelman, S., 579  
 Spindel, W., 32  
 Spoerl, Edward, 580  
 Spurrell, Francis A., 296  
 Squire, Helen M., 872  
 Stacey, M., 353  
 Stadtman, E. R., 518  
 Stafford, Helen A., 795, 904  
 Stainer, R. Y., 404  
 Stankovic, D., 905  
 Staples, Richard C., 906  
 Stavitsky, Abram B., 334  
 Stehlik, Gerhard, 339  
 Stein, O. L., 907-8  
 Stelos, P., 333  
 Stent, Gunther S., 272, 513-14, 581-82  
 Steward, F. C., 909  
 Stewart, J. D., 744-45, 910-11  
 Stevenson, A. C., 278  
 Stiffel, C., 92  
 Stitt, Clyde, 776  
 Stocken, L. A., 148  
 Stoicovici, F., 202  
 Stonier, T., 583  
 Stoppani, A. O. M., 163, 584-86  
 Stout, P. R., 912  
 Strain, H. H., 913-15  
 Strang, Verda G., 358  
 Stranks, D. R., 428  
 Strauss, Bernard S., 587  
 Stromnaes, O., 279  
 Sudia, T. W., 917  
 Suess, H. E., 677  
 Sugiyama, H., 588  
 Sullivan, Robert L., 232  
 Sulitzeanu, B. D., 312  
 Sun, Sung Huang, 49, 491  
 Sunakawa, Sumiko, 448  
 Suszko, I. M., 320  
 Suzuiki, Michio, 715  
 Suzuki, Isamu, 589-90  
 Swabey, L., 316  
 Swaminathan, M. S., 831  
 Swanson, H. D., 951  
 Sweet, Dorothy, 356  
 Swim, H. E., 397  
 Synder, Leon A., 271  
 Syrett, P. J., 918  
 Szafarz, David, 153  
 Szczepkowski, T. W., 542  
 Szeplaky, K., 251  
 Szolnoki, Janos, 591  
 Szulmajster, Jekisiel, 592  
 Szybalski, W., 150

### T

Tabentskii, D. A., 720  
 Takamatsu, Ken, 593  
 Takano, K., 164  
 Takehara, Minoru, 594  
 Takiguchi, Shoji, 738  
 Tallentire, A., 595-96  
 Tamiya, Hiroshi, 439, 741  
 Tarakanova, G. A., 773  
 Tarasova, A. D., 666  
 Taschdjian, C. L., 474  
 Taylor, J. Herbert, 174, 280-82  
 Taylor, Joyce, 597

Teel, M. R., 839  
 Telitchenko, M. M., 203  
 Templeton, W. L., 710  
 Tepper, B. S., 598  
 Terakawa, Akira, 823  
 Terent'eva, Z. A., 401  
 Thiman, Kenneth V., 919  
 Thomas, Charles A., Jr., 508, 599  
 Thomas, M. R., 914-15  
 Thomason, D., 159  
 Thompson, G. A., Jr., 854  
 Thompson, H. R., 509  
 Thomson, J. F., 49  
 Till, J. E., 172  
 Timofeeva-Resovskaya, E. A., 207-9, 920  
 Timofeev-Resovskii, N. V., 208-9, 920  
 Tipples, K. H., 921  
 Tokarskaya, V. I., 780-81, 922-23  
 Tolbert, B. M., 662  
 Tollin, Gordin, 684  
 Tolmach, L. T., 260  
 Tomikura, Yoshio, 765-66  
 Tomizawa, Chojiro, 924  
 Torretta, A., 321  
 Tortarolo, E., 600  
 Tosteson, D. C., 165  
 Towers, G. H. N., 746  
 Towne, Jack C., 355  
 Townsley, Sidney J., 178  
 Trager, Lothar, 614  
 Trebst, A., 896-97, 925-26  
 Trinkaus, J. P., 166  
 Trudinger, P. A., 601  
 Tselishev, S. P., 927  
 Tserling, V. V., 928  
 Tso, T. C., 929  
 Tsujimoto, Harry Y., 926  
 Tsukamura, Michio, 283-85  
 Tsyban, E. P., 302  
 Tucker, F. L., 602  
 Tumanian, V. G., 286  
 Turchin, F. V., 930  
 Turco, Gian Luigi, 167  
 Turkina, M. V., 777  
 Turner, James E., 128, 931  
 Tushnyakova, M. M., 932  
 Tustanowski, S., 525

### U

Uhler, R. L., 744-45, 845, 933-35  
 Ullmann, Agnes, 411  
 Ulrich, B., 885  
 Uphaus, R. A., 387  
 Urban, Rosmarie, 862  
 Uvarova, O. A., 345-46

### V

Vago, T. E., 419  
 Vaklinova, S. G., 694, 936  
 Valentine, R. C., 521  
 van de Pol, J. H., 605  
 Van der Kamp, C., 558  
 Van Dilla, Marvin A., 641  
 Van Dyke, J. G., 603  
 Vanek, Z., 607  
 Van Horn, E., 604  
 van Severen, R., 937  
 Van Tubergen, R. P., 367, 606  
 Vard'ya, N. P., 959  
 Vartapetyan, B. B., 938

## AUTHOR INDEX

Vasilenko, A. G., 608  
 Vasil'ev, E. N., 939  
 Vazquez, Matilde Martinez, 940  
 Vennesland, Birgit, 806  
 Venters, Lydia, 881  
 Veres, K., 607  
 Verly, W. G., 168  
 Vernon, Leo P., 734  
 Veselov, I. Ya., 609  
 Vidol, 718  
 Vielmetter, W., 463-64  
 Villares, Margarita Celma, 83  
 Villegas, Leopoldo, 941  
 Vinogradov, A. P., 610-12  
 Vishniac, Wolf, 942  
 Vlassiyuk, P. A., 943  
 Vogel, Henry J., 944  
 Volkin, Elliot, 348, 383, 613  
 Volkova, G. A., 230-31  
 Volkova, T. M., 277  
 Volpi, A., 669  
 von Ehrenstein, G., 169  
 Voznesenskii, V. L., 945, 956

### W

Wacker, Adolf, 574, 614-15  
 Waelsch, Heinrich, 527  
 Wagle, S. R., 170  
 Waldner, H., 764  
 Walker, D. A., 946  
 Wallace, Arthur, 704, 947  
 Walper, J. F., 602  
 Walsh, P. M., 115  
 Wang, Chih H., 465, 532  
 Wannemacher, R. W., Jr., 636  
 Ware, G. C., 604  
 Warkalla, E. M., 642  
 Warner, Robert C., 379  
 Wasserman, R. H., 643-45  
 Watanabe, K., 619  
 Watson, D. G., 210-12  
 Watson, J. D., 473  
 Watson, R. W., 380  
 Watts, J. W., 171  
 Webb, J. A., 711  
 Wedding, Randolph T., 948  
 Weichart, G., 898, 900  
 Weigle, William O., 301  
 Weinstein, Leonard H., 950  
 Weisglass, H., 616  
 Weiss, Allen J., 784  
 Wellings, S. R., 160  
 Welte, Erwin, 617, 903, 949  
 Werk, O., 338  
 Werkman, C. H., 589-90  
 Westphal, Otto, 496  
 Whatley, F. R., 870  
 Whitmore, G. F., 172

Wieneke, A. A., 173  
 Wiener, H., 474  
 Wiggins, A. D., 637  
 Wildy, P., 138  
 Williams, D. L., 762-63  
 Williams, Louis G., 213, 951  
 Williams, Watkin, 952  
 Wilson, J. B., 598  
 Wimber, Donald E., 287  
 Winebright, James, 304  
 Wiser, W., 664  
 Wittenberger, C., 202  
 Wittmann, H. Gunter, 567  
 Wlodawer, Paulina, 244  
 Wolf, Benjamin, 334  
 Wolf, Beverly, 618  
 Wolfe, R. S., 521-22  
 Woodin, A. M., 173  
 Woods, Philip S., 174, 274  
 Work, T. S., 504  
 Wormall, A., 30  
 Wright, D. E., 405  
 Wright, Elmer M., 351  
 Wright, J. B., 646  
 Wu, C. W., 378  
 Wyssmann, Lucien, 153

### Y

Yagi, Yasuo, 322, 333  
 Yalow, Rosalyn S., 292  
 Yamafuji, K., 619  
 Yamagata, N., 184, 214-15, 647-48  
 Yamaguchi, M., 743  
 Yamamura, Yoshihiro, 620  
 Yamamura, Yuichi, 482  
 Yasnikov, A. A., 891  
 Yatazawa, Michihiko, 953  
 Yeh, Yu-Yuen, 686  
 Yi, Yong-gyu, 954  
 Yoshikawa, Hiroshi, 534  
 Young, Roger H., 888, 955  
 Young, Ruth S., 400  
 Yudintseva, E. V., 731-32  
 Yunevich, V. I., 894

### Z

Zacharias, B., 169  
 Zaitseva, G. N., 621  
 Zalenskii, O. V., 956  
 Zamenhof, S., 393  
 Zaprometov, M. N., 957-58  
 Zeman, K., 622  
 Zertsalov, V. V., 928  
 Zharova, T. V., 623-25  
 Zhdanov, V. M., 364  
 Zhezhe, N. G., 959  
 Zhogova, V. M., 626-27  
 Zimmerman, A. M., 262

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# REPORT AVAILABILITY INDEX

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11678	204	
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4	731	

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# ISOTOPES INDEX

- Actinium-228, 77  
 Aluminum-27, 82  
 Antimony-122, 41  
 Antimony-124, 41  
 Astatine-211, 15-6, 19-20  
 Barium-133, 74  
 Barium-140, 44, 76, 238  
 Bromine-80, 663  
 Cadmium-115, 209, 238  
 Calcium-2+, 849  
 Calcium-40, 873  
 Calcium-45, 5, 9, 11, 15, 19, 38, 40-2, 51, 66-7, 69, 72, 75-7, 81-2, 209, 229, 234, 238, 296, 398, 628, 642, 645, 658, 686, 729, 823, 859, 864, 873, 911, 934-35, 943  
 Calcium-47, 5-8, 60  
 Carbon-1, 49  
 Carbon-2, 360  
 Carbon-12, 3, 761, 842-43  
 Carbon-13, 677, 761, 842-43  
 Carbon-14, 3, 6, 9-10, 18, 23, 25, 28, 44, 47, 87, 104, 119, 129, 132, 163, 204, 216, 235, 245, 252-53, 266, 279, 309-10, 312, 329, 357-58, 375-76, 380, 401-2, 411, 421, 426, 451, 453, 455-58, 471-72, 480-81, 510, 539, 541-43, 545, 567, 569, 584, 598, 607, 615, 660, 663, 672-73, 677, 683-84, 687, 701, 706-7, 711, 715, 717, 721, 726-27, 730, 753-54, 756, 758, 763, 765-66, 780-81, 792-95, 807-10, 819, 822, 825, 827, 830, 833, 844, 846, 848, 860, 862, 881, 887, 896, 904, 914, 919, 923, 925, 931, 956-57  
 Cerium-141, 42  
 Cerium-144, 2, 17, 42, 209, 231, 656, 704, 729, 732, 850, 868-69, 920  
 Cesium-134, 650  
 Cesium-137, 2, 5, 13, 21, 34, 38, 42, 44, 60, 68-9, 75, 78, 81-2, 182, 184, 190, 194, 198-200, 209, 213, 223-25, 230, 428, 637, 649, 656, 688-90, 692-93, 729, 732, 744, 748, 752, 818, 834, 845, 868-69, 910-11, 920, 951  
 Chlorine-36, 864  
 Chromium-51, 28, 82, 169, 209, 288, 307-8  
 Cobalt-60, 9-11, 28, 75, 116-17, 156, 164, 209, 237, 269, 297, 321, 323, 339-40, 378, 413, 418, 428, 459-61, 483, 489, 519, 543, 632, 656-57, 666, 676, 780-81, 805, 851, 864, 901, 907-8, 920, 932  
 Cobalt-137, 72  
 Deuterium, 3, 9, 11, 13, 22, 49-50, 52-3, 130, 154-55, 286, 368-69, 387-88, 392-94, 415, 442, 476-77, 491, 498, 500-1, 506, 549, 561, 662, 681, 687, 709, 828, 913-15  
 Fluorine-18, 25, 784, 877  
 Fluorine-19, 784  
 Germanium-71, 209  
 Gold-198, 5, 28, 33  
 Hydrogen-3, 101-2, 162, 166, 248, 253, 274, 279, 287, 324, 341, 547, 907  
 Iodine-125, 304, 478  
 Iodine-129, 27  
 Iodine-131, 5, 7-8, 18, 21, 28, 34, 36-40, 42, 44, 61, 68-9, 73, 92, 209, 214, 238, 250, 291-94, 300, 303-5, 317-18, 321-22, 330-32, 343, 366, 373, 382, 423-24, 648, 744-45, 805  
 Iron-54, 82  
 Iron-55, 33  
 Iron-58, 82  
 Iron-59, 10, 18, 33, 41, 82, 209, 226, 238, 343-44, 729, 864, 917, 920, 941  
 Krypton-85, 71  
 Lanthanum-140, 44  
 Lead-210, 72, 740  
 Magnesium-28, 655  
 Manganese-54, 82  
 Mercury-209, 209  
 Neptunium-239, 82  
 Niobium-95, 2, 41-2, 44, 209, 641, 710, 920  
 Nitrogen-14, 444, 780-81  
 Nitrogen-15, 371, 444, 512, 653, 780, 800, 916, 928, 930, 953  
 Oxygen-15, 705  
 Oxygen-16, 842  
 Oxygen-18, 25, 684, 717, 842, 877, 938  
 Phosphorus-31, 432  
 Phosphorus-32, 5, 11, 18, 21, 28, 38-41, 61, 69, 98-9, 113, 139, 147-49, 158, 175-77, 180, 187-90, 192-93, 201-2, 209-10, 226, 229, 232, 234, 236, 238, 244-45, 251, 254, 256, 259, 263, 267, 271-72, 275, 283-85, 290, 293-94, 298, 302, 335, 343, 346, 364, 366, 370, 409-10, 429, 431-32, 438, 453, 462, 464, 466, 468, 474-75, 479, 486, 496, 508-9, 517, 523-26, 543, 556, 558-59, 577, 583, 594, 620-22, 652, 654, 657-58, 669, 675, 696, 701-3, 729, 733, 735-36, 764, 767, 774, 787, 789, 801, 805, 807, 820-21, 840, 848, 864, 885, 892, 898-900, 905, 917, 940, 943, 952  
 Phosphorus-33, 462  
 Plutonium-239, 36, 39, 42, 68, 72, 80-1, 352  
 Polonium-210, 61, 399, 535, 740, 814  
 Potassium-32, 381  
 Potassium-40, 72, 610-12, 617, 640  
 Potassium-42, 72, 75, 139, 381, 818  
 Praseodymium-144, 42  
 Promethium-147, 231, 704  
 Radium, 78, 485, 959  
 Radium-224, 76  
 Radium-226, 13, 72, 74, 76-7, 80, 196  
 Radium-228, 76-7  
 Rhodium-103m, 44  
 Rhodium-106, 704  
 Rubidium-86, 201, 209, 657, 688, 692-93, 729, 864  
 Ruthenium-103, 44, 744, 815  
 Ruthenium-104, 815  
 Ruthenium-105, 815  
 Ruthenium-106, 2, 21, 36, 39-40, 61, 209, 231, 656, 729, 732, 744, 815, 868-69, 920  
 Scandium-45, 82  
 Scandium-46, 41  
 Scandium-47, 41  
 Selenium-75, 678  
 Sodium-24, 82, 139, 190  
 Strontium-85, 7-8, 10, 12, 69, 74, 81-2, 213, 223, 296, 645, 725, 785, 911, 934-35, 947  
 Strontium-89, 38, 70, 76, 190, 228, 232, 234, 238, 398, 628, 708, 848, 873, 917, 949  
 Strontium-90, 2, 9-13, 17-9, 20-1, 35-6, 38-9, 40-2, 51, 66-7, 69, 72, 76-7, 80-2, 178, 182, 190, 194-95, 197, 205-6, 209, 223-24, 230, 261, 266, 283, 336, 626, 633, 649-51, 656, 729, 732, 747-48, 813, 834-35, 848, 850, 859, 866-68, 875, 880, 882-83, 903, 920, 933, 935, 949  
 Sulfur-32, 2, 284  
 Sulfur-35, 37, 41, 66-7, 110, 136, 209, 234, 308, 338, 343, 373, 425, 509, 542, 583, 587, 615, 663, 675, 702, 717, 733, 773, 848, 864, 879, 889, 920, 943  
 Tellurium-129, 74  
 Thorium, 45, 62, 78, 564  
 Thorium-227, 74  
 Thorium-228, 75  
 Thorium-232, 76  
 Tritium, 6, 12, 22, 26, 41, 46-7, 81, 84-6, 101, 118, 138, 140-42, 144, 152, 162, 166, 168, 248, 257-58, 268, 280, 282, 287, 324, 337, 341-42, 361, 426, 538, 544, 548, 553, 606, 635, 684, 717, 765, 827, 896-97, 906-7  
 Tungsten-185, 40, 943  
 Uranium-233, 35  
 Uranium-234, 25  
 Uranium-235, 25, 35  
 Uranium-236, 25  
 Ytterbium-90, 42  
 Yttrium-90, 9, 28, 35, 41-2, 69, 77, 81, 178, 835  
 Yttrium-91, 66-7, 209, 238, 241-42, 704, 850, 868-69, 920  
 Zinc-65, 5, 36, 38, 40-2, 68-9, 81-2, 179, 209, 211-12, 233, 238, 641, 661, 691, 848, 864-65, 895, 920  
 Zirconium-95, 2, 41-2, 44, 209, 641, 710, 732, 920

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Syracuse, Syracuse University

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## NORTH CAROLINA

Charlotte, Public Library of Charlotte

and Mecklenburg County

Durham, Duke University

Raleigh, North Carolina State College

## NORTH DAKOTA

Grand Forks, University of North Dakota

## OHIO

Cincinnati, University of Cincinnati

Cleveland, Public Library

Columbus, Ohio State University

Toledo, University of Toledo

Youngstown, Youngstown University

## OKLAHOMA

Norman, University of Oklahoma

Stillwater, Oklahoma State University

## OREGON

Corvallis, Oregon State University

Portland, Reed College

## PENNSYLVANIA

Philadelphia, University of Pennsylvania

Pittsburgh, Carnegie Library

University Park, Pennsylvania State

University

## PUERTO RICO

Rio Piedras, University of Puerto Rico

## RHODE ISLAND

Providence, Brown University

## SOUTH CAROLINA

Columbia, University of South Carolina

## TENNESSEE

Knoxville, University of Tennessee

Memphis, Public Library

Nashville, Joint University Libraries

Oak Ridge, Oak Ridge Associated Universities

## TEXAS

Austin, University of Texas

College Station, Texas A & M University

Dallas, Southern Methodist University

Houston, Rice University

Lubbock, Texas Technological College

San Antonio, Public Library

## UTAH

Salt Lake City, University of Utah

## VIRGINIA

Blacksburg, Virginia Polytechnic Institute

Charlottesville, University of Virginia

Norfolk, Old Dominion College

## WASHINGTON

Pullman, Washington State University

Seattle, University of Washington

## WEST VIRGINIA

Morgantown, West Virginia University

## WISCONSIN

Madison, University of Wisconsin

Milwaukee, Public Library

## WYOMING

Laramie, University of Wyoming